Physical to Biological Building Blocks in Hand & Microsurgery

The Facts, The Face, The Facility, The Field… and The Future

INAUGURAL LECTURE SERIES

The Inaugural Lectures are given by honored faculty members within the University who have obtained the rank of full professor. This event gives the honoree and opportunity to deliver a lecture to fellow faculty and other university guests concerning his/her work and research interests.

The context of the lecture itself typically includes a summary of the evolution and nature of the honoree's specialized field, highlights some of the general issues of that particular field, and a description of how the honoree situates his/her work within their field.

UPM conducts this event to highlight and bring attention to the scholarly work that is being by its distinguished faculty and to illustrate how the work contributes to mankind as a whole.

UPM
UNIVERSITI PUTRA MALAYSIA
BERILMU BERBAKTI

Universiti Putra Malaysia Press
43400 UPM Serdang
Selangor Darul Ehsan

Tel: 03-89468851/89468854
Fax: 03-89416172
Email: penerbit@upm.edu.my
Web: www.penerbit.upm.edu.my

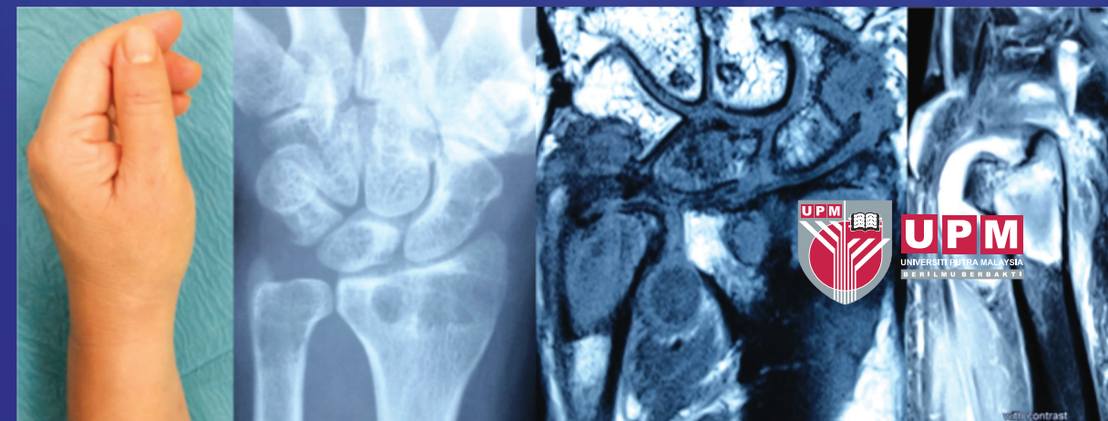
ISBN: 9789789673445

Professor Dr. Sharifah Roohi Syed Waseem Ahmad

Professor Dr.Sharifah Roohi
Syed Waseem Ahmad

Physical to Biological Building Blocks in Hand & Microsurgery

The Facts, The Face, The Facility, The Field… and The Future



Physical to Biological Building Blocks in Hand & Microsurgery

The Facts, The Face, The Facility, The Field… and The Future

Professor Dr. Sharifah Roohi Syed Waseem Ahmad

Physical to Biological Building Blocks in Hand & Microsurgery

The Facts, The Face, The Facility, The Field… and The Future

Professor Dr. Sharifah Roohi Syed Waseem Ahmad

MD (UKM) FRCS (Ed) MS Orth (UKM) Dip Hand Surg (Eu)

Fellowships in Hand &Microsurgery (Singapore, USA)

10th August 2018

Dewan Kuliah Utama • Faculty of Medicine & Health Sciences

Universiti Putra Malaysia

Universiti Putra Malaysia Press

Serdang • 2018

www.penerbit.upm.edu.my

Cetakan Pertama 2018

Penerbit UPM adalah anggota Persatuan Penerbit Buku Malaysia (MABOPA)
No. Ahli: 9802

Sharifah Roohi Syed Waseem Ahmad, Prof., Dr.
PHYSICAL TO BIOLOGICAL BUILDING BLOCKS IN HAND & MICROSURGERY : The Facts, The Face, The Facility, The Field... and The Future / Professor Dr. Sharifah Roohi Syed Waseem Ahmad.
ISBN 978-967-344-814-2
1. Hand--Surgery. 2. Microsurgery. I. Title.
617.575059

Reka letak teks : Sahariah Abdol Rahim @ Ibrahim
Reka bentuk kulit: Md Fairus Ahmad

Reka bentuk, reka letak dan dicetak oleh
Penerbit Universiti Putra Malaysia
43400 UPM, Serdang
Selangor Darul Ehsan
Tel : 03-89468851/8854/8429
Faks : 03-89416172
E-mel : penerbit@upm.edu.my
Laman web : http://penerbit.upm.edu.my

Contents

ABSTRACT

The Hand is a truly remarkable instrument - an organ of perception (feel, touch and much more), performance (power grip and fine motor functions), perspiration (sweating assists us in handling items and reducing body temperature), presentation and even communication. Second to the face the most commonly presented part of the body is the hand, thus its appearance of normalcy is crucial. Many a time when we are unable to verbalise our thoughts, we convey our messages, knowingly or otherwise, through non-verbal hand gestures as well as body language. Meanwhile, in dance forms and miming the hands are essential aspects of communication. Similarly sign language is basically that – an entire language communicated via the hands! Anatomically, due to the high density of nerve fibres at the fingertip, digits also aid in stereognosis which enables the blind to "see" and the deaf to "hear" (Alpenfels EJ 1955). The fact that the hand is structurally positioned at the extreme end of the upper limb, to enable it to reach out approximately one metre away from the body, however, makes it extremely susceptible to injury.

Injury to the hand and wrist is devastating. All it takes is to imagine a day in one's life without the right or even left hand. It becomes evident that a major portion of our lives and activities of daily living are dependent on us being able to have complete hand (and upper limb) function. In order for us to get through the day, there are numerous bimanual activities we perform without a thought. Even a minor papercut precludes us from continuing with these normally. Thus, hand injuries from the fingertip to the shoulder are functionally and emotionally distressing and need to be addressed immediately. Most importantly the injury or pathology needs to be **treated right the first time.**

The Hand and Microsurgery field is a sub-specialty dealing with the treatment of conditions pertaining to the entire upper limb from fingertip to shoulder (Wikipedia). This includes both surgical and non-surgical management of congenital and paediatric conditions, trauma, infection, inflammation, haematological aspects, tumours, compression neuropathies, brachial plexus, the spastic hand, degenerative conditions and miscellaneous conditions such as Dupuytren's and lymphatic anomalies.

This relatively new sub-specialty of surgery developed rapidly in the 20th Century. The works of various researchers, clinicians and surgeons in this area brought about a conglomeration of discoveries which in themselves were remarkable but integrated together provided immense opportunities and ginormous developments. The most significant contribution of Sterling Bunnell, the Father of Hand Surgery, I feel, came in the form of a deep understanding of the intricate anatomy of the hand and its connection to function. He pioneered meticulous techniques, characterised by careful, detailed dissection with an eye on precision, leading to outstanding results, which he practically demonstrated by sharing his surgical techniques around the country (Green SA 2013). Developments in the 1960s, both mechanical and technical, allowed small diameter vessels (of 1 mm or less) to be repaired, opening up a plethora of possibilities and enabling various fields to collaborate for the betterment of the inflicted patient. Thus candidates from the fields of Orthopaedics, Plastic and General Surgery all enter this highly specialised field with the same philosophy: to repair, reconstruct and even replace. Great emphasis is placed on regaining function by therapy both prior to and after surgical or even non-surgical treatment.

In the 70s and 80ss, as the field took off, anatomical discoveries of new flaps and arterial patterns and microsurgical refinement of the surgical application of these findings kept the momentum

going and the excitement building. The birth of Reconstructive (Micro and even Supermicro – 0.3mm to 0.8mm diameter vessels) Surgery brought about new developments with the advances in transplantation medicine allowing amazing technical feats and repair of the human body .

Another exciting area is that of biomedicine where the implant sizes are getting smaller, from mini to micro, and moving from surgical steel to Titanium and finally, bioabsorbable materials. Incisions are also reducing in size, assisted by arthroscopic equipment and innovative techniques. All are changing the way surgery is performed and raising the expectation bar higher. Currently however, we are moving slowly but surely to replacement not by physical means but by biological means, mainly rebuilding and regenerating lost tissue by chemical and biological options.

Developing countries have both embraced this field as well found difficulties in implementing the finer aspects. Despite the costs being high and the learning curve steep, this has not deterred them. I feel that the excitement of discovering novel ways to tackle previously "impossible" cases has allowed this field of surgery to blossom.

I shall discuss the origins of this subject and how it made an entry into our country (**The Facts**), both clinically as well as academically, the progress at present in terms of manpower development and what it takes to become a Hand Surgeon (**The Fac**e). This will be followed by the development of the infrastructure required to support it (**The Facilities**). The main essence will be examples of cases that have been seen and what needs to be addressed (**The Field**) as well as what I see for **The Future** in terms of prospects for upcoming surgeons and of course, the patients.

INTRODUCTION

The Life of a Hand and Microsurgeon is an exciting one. Although the initial training is rigorous, to say the least, the field is wide and varied with never a dull moment. This young surgical specialty, being an amalgamation of general, plastic and orthopaedic surgery, had its origins in the 20th Century, during the First World War. Understanding its beginnings will help in understanding the efforts required in not only the making of a hand surgeon but also his surroundings.

The Historical Development of Hand and Microsurgery

Although vascular ligatures were first seen in the 1500s, the turn of the 20th Century (1900) is when Carrel and Guthrie are credited with performing transplantations of composite tissues and organs in experimental animals (Sade RM 2005). Together with the development of Heparin by McLean and Howell in 1916 (Wardrop D & Keeling D 2008), which enhanced the success rate of vascular repair, and the monocular microscope by Carl-Olof Siggesson Nylén (1921) and a binocular one by Holmgren (1922) followed by the microsurgical instruments plus sutures – the picture for microvascular repair comes together. The clinical applications thus exploded into neurosurgery, maxillofacial, hand and plastic surgery including numerous options for transplantations of tissues and organs (Tamai S 2009).

In 1908, a young surgeon in making, Sterling Bunnell, graduated from the San Francisco School of Medicine and became interested in tendon surgery. Sterling Bunnell submitted an article (Repair of tendons in the fingers) to the prestigious *Surgery, Gynaecology & Obstetrics,* which was revised 18 times and finally published in

1918. While serving in France during the "The Great War" as the Chief of Surgical Services, he was determined to find a solution to the high upper limb amputation rate. He went back to his clinic "The San Francisco Shoulder, Elbow & Hand Clinic" and worked tirelessly and exclusively on the upper limb. Between the two World Wars, Bunnell was prolific as a surgeon and as a writer, publishing ingenious solutions to challenges in hand surgery, developing innovative techniques and giving birth to a new species "The Hand Surgeon: *Homo Chirurgimanus"* (Green SA 2013). When WWII broke out, he was enlisted by General Kirk (the Army Surgeon General) to establish hand surgery and rehabilitation centres, so Bunnell decided to shut down his clinic. He undertook his task seriously and travelled across the USA personally imparting his techniques and ideas while at the same time, establishing nine Army hand centres (Green SA 2013). His trademark ideas of the structure of a hand unit or centre, the specific surgical methods, the training and staffing, all form the basis of our present day training and unit structure! That was the strength of the individualised training in creating the *Homo Chirurgimanus,* leaving a legacy of second generation hand surgeons in Boyes, Littler, Fowler, Phalen, Barsky and Platt. This is another tradition that holds strong till the present and which accounts for the high standards maintained in this special field.

Reconstructive Microsurgery

The advent of the operating microscope and the finer sutures that were swaged to the needle along with appropriate microsurgical instruments were the breakthroughs that led to the flood of ideas and innovative reconstructive techniques. Drs. Harold Kleinert and Morton Kasdan were the first to perform a successful anastomosis

in a digital (partial) amputation in 1963, followed by Harry Buncke in 1964 who reattached a rabbit's ear. The commonality of vessel (of less than 1mm in diameter) repair allowed tissue transplantation and free flaps to blossom, including fibular transfers for maxillo-facial malignancies.

Supermicrosurgery

Once the microsurgical techniques were mastered and fluent, technological advances allowed even smaller diameter vessels (0.3mm to 0.8mm) to be joined safely without any adverse events (Badash et al 2018). Once used to salvage failing fingertip replantations, the techniques are now applied to lymphovenous and perforator anastomoses. Taylor and Palmer mapped out the perforator flaps for the whole body (1987) while Koshima et al. described the use of such perforator flaps (1989). Obviously a higher skill set level is required is such endeavours, as provided by extensive practice and training (Badash et al 2018).

Setting up Centres

The way to propagate Hand & Microsurgery is by setting up training centres run by dedicated and well-trained surgeons across the country, similar to the mould created by Bunnell over 75 years ago. Surgical expertise is acquired by apprenticeship and **there are no shortcuts**. If shortcuts are taken, disastrous outcomes will result for the public at large which will be difficult to contain. Deficits in the centres, in terms of qualified staff, inferior equipment or shoddy care, would translate into sub-standard results, and mistakes in Hand & microsurgery are unforgiving.

THE FACTS (AND FIGURES)

Malaysian Setting

Hand Surgery in Malaysia had its beginnings in the 1960s, in the form of treatments provided for patients with Leprosy. They were isolated from mainstream society in a leprosarium set up in a small town called Sungai Buloh, 15 minutes from the capital, which is now a part of greater Kuala Lumpur. Dr. K Thambyrajah (who had performed two fellowships with Mr. Guy Pulvertaft) and Dr. Daksinamoorthy worked together to treat mainly ulnar nerve palsies and perform Brand's tailed tendon transfer using Palmaris Longus (T Sara Ahmad 2011). Luckily for them only 10% of the population or less do not have this tendon (SA Roohi 2007).

University Malaya, under the headship of Professor P. Balasubramaniam, started a microsurgical practice laboratory and the first wrist replantation was performed in 1983. Dato' Dr. Abdul Hamid Abdul Kadir was the next to go on a fellowship to the UK (under Mr Campbell Semple) and subsequently, he moved to Universiti Kebangsaan Malaysia (UKM) where he too established a microsurgical laboratory and organised the first International Hand Course under the Malaysian Orthoapaedic Association's (MOA) banner in 1983. Meanwhile, Prof. Dato' Dr. Tunku Sara Ahmad who went to Singapore and completed a two year fellowship in Hand Surgery, under the tutelage of Professor Robert Pho, returned to continue in University Malaya in 1988. The Malaysian Society for Surgery of the Hand (MSSH) was formed on 3rd March 1993 (3-3-93) with Dato' Dr. Abdul Hamid as its first President.

In the meantime, Dato' Dr. V. Pathmanathan completed a one year fellowship in Louisville, Kentucky and returned to start up the first Hand Clinic in General Hospital Kuala Lumpur in 1987. It went on to become the country's first Hand and Microsurgery Department

under the Ministry of Health (MOH) in 1998 (MSSH webpage). Dr. Ranjit Singh Gill was the second Malaysian to complete a fellowship in Louisville in 1996. The Hand Unit in GHKL was then extremely busy with trauma cases, with replantations being performed almost every day, and it can lay claim to training many an orthopaedic resident from UKM.

In 2000, feeling the need to have its own hand service, it was decided that Dr. Sharifah Roohi be tasked with setting up a Hand Unit in UKM. She thus became the third person to go to Louisville. She undertook two fellowships, one in Singapore and another in USA. Armed with the specific knowledge to set up the unit, she returned in June 2003 and set up the Hand Unit in UKM, which was officiated open on 16th November 2006. There have been two trained Hand Surgeons from that unit since, A/Professor Dr. Jamari Sapuan and A/Prof Dr. Shalimar Abdullah. It is a thriving unit and a good training ground for Orthopaedic residents.

In 2011- 2012, while preparing for the 10th APFSSH congress, it was noted that there were less than 20 hand surgeons in the country. As the President of the MSSH, my hope was to have 50 by 2020 which seemed outrageous at the time. At present count, there are approximately 900 Orthopaedic surgeons in Malaysia, half of whom are in the public sector, bringing the ratio of orthopaedic surgeons to population to 1: 36,000. Among these there are only 40 hand surgeons (about 4%), but there are still two and a half years left to December 2020, so we may still reach 50! The current hand surgeon to population ratio works out to 1:800,000, which explains why we have so much work to do. There are no official figures from the World Health Organisation (WHO) on this ratio, but I would think 1:200,000 is reasonable (10% of the total number of orthopaedic surgeons) for a developed country. That would mean 160 hand surgeons, quadruple the present number.

At present, there are three Universities with a full-fledged Hand Unit, performing emergency hand calls and elective cases. MOH also has three such units while the private sector has only two. We should aim to increase these basic building blocks, collaborate and amalgamate positive points in order to extend the borders covered by the centres. This will reduce complication rates and perhaps then we can concentrate on improving the quality of care.

THE FACE – THE MAKING OF…

The making of a hand surgeon is not an easy task. Similar to how we describe the different personalities of a physician and a surgeon, the candidate for hand surgeon has a particular personality. They are no mere mortals for they must have the stamina of a marathoner, the patience of a mother, the dexterity of a juggler and finally a dash of the temerity of a tightrope walker. As is obvious, we are not perfect in all these aspects, so we have to make do with what we have!

Of the above ingredients, the most important criteria is the intense desire to become a hand surgeon. I found that feeling in my fourth year of medical school when I met a patient who elicited my deepest sympathy. A 33 year old farmer, the father of a two year old girl, had a motorcycle accident and had a flail lower limb (sciatic nerve injury) with an open knee injury. The solution offered to him was an above knee amputation, which in his opinion was a death sentence to him, being a farmer and not being able to feel the earth beneath his feet. Although I was not aware of the field then I knew which direction I wanted to head towards. Thus the journey began…

It is a long and arduous journey, but one which was extremely worthwhile. Basic requirements to venture into the field are a medical degree followed by (in Malaysia) a postgraduate degree

in either Plastic or Orthopaedic Surgery. This will enable the candidate to either follow the 3 year fellowship programme (MOH) or University programmes which comprise one year fellowship overseas and two years of in-house training. Only three countries in the world offer Hand Surgery as a stand-alone residency programme – Singapore, Sweden and Finland, and it ranges from four to six years' duration.

In my case, I embarked on this journey with an intense focus on acquiring as much knowledge and skills as possible. During my residency, I took a month's leave to extend my time in the Hand & Microsurgery unit in General Hospital by month and a half, during which time I managed to perform a few replantations and revascularisations successfully, giving me confidence to further my training in this field. Within two months of completing the posting, I passed the Fellowship examination and was chosen to set up the unit in UKM. My fellowship training and future were already planned out and thus I had a "fast-track" route to sub-specialisation. After my Masters and before I left for the Fellowship programme, I was tasked with running the Hand Clinic and theatre list for upper limb cases, preparing me further for what was to come.

Hand Surgery Fellowships: HRM Department, Singapore.

The six-month fellowship in the Hand & Reconstructive Microsurgery (HRM) Unit, National University Hospital (NUH), Singapore, consisted of two stints of three month rotations with Prof Robert Pho and Prof Lim Beng Hai, respectively. As Fellows, we were required to be on "hand call" approximately one in three and

we performed all the emergency cases that came in since the fellow was the seniormost "in-house" team member. The cases we worked on ranged from simple fingertip injuries (Figure 1) to complex trauma (Figure 2) requiring vascular or microvascular work.

Figure 1 Fingertip injury in a five year old child.

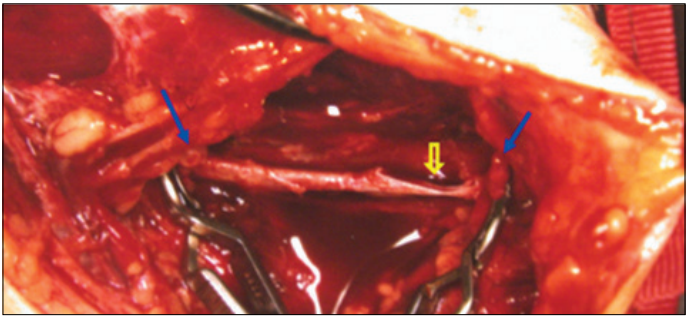


Figure 2 Scalloped section of brachial artery (yellow arrow) causing massive bleeding and hypovolemic shock.

There were teaching sessions 2-3 times a week and rounds on alternate days where the previous day's emergency cases were discussed. These were great learning sessions for me. It was also compulsory to take the basic microsurgical skills course (Figure 3), with an examination at the end of the course (Figure 4).

Figure 3 The microsurgical lab.

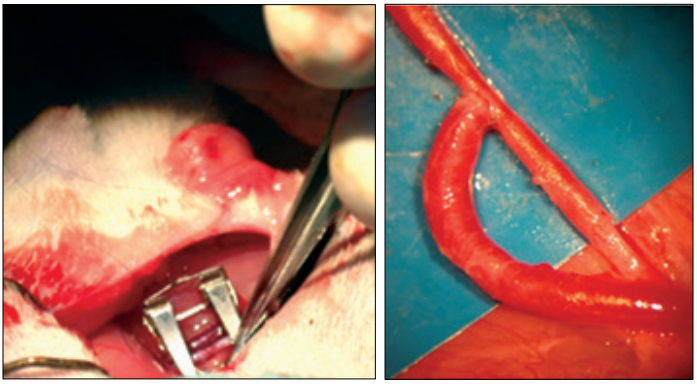


Figure 4 The Rat femoral artery anastomosis.

The advanced course, though optional, was very useful, showing various flaps such as: Latissimus Dorsi, Rectus, Groin, Gracilis, Gastrocnemius, etc. (Figure 5,6).

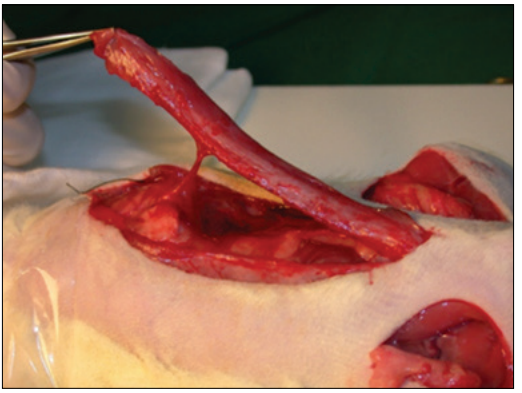


Figure 5 The Rectus Abdominis flap.

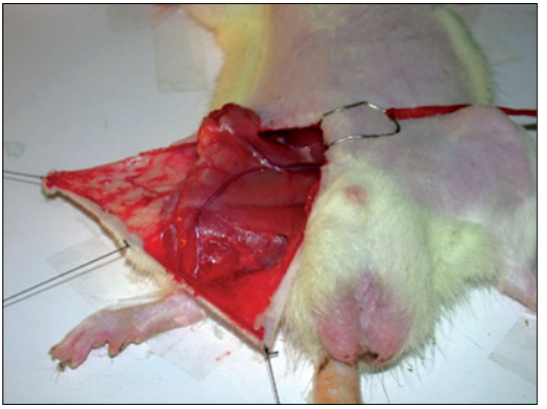


Figure 6 Dissection of the Rat groin.

During the entire six month period, I was involved in 233 cases, of which 168 were trauma cases.

There were 19 microvascular cases – either replantations, revascularisations or free flaps. There were a similar number of loco-regional flaps such as: Thenar, Moberg, Posterior Interosseous,

Groin etc. This gave me a good grounding on the coverage of fingertip injuries as well as coverage of defects around the hand. There were also a few memorable cases from which I learnt a lot. These included a degloving injury to the leg, foot and ankle (Figure 7), an osteosarcoma of the distal femur with autograft post-irradiation (Figure 8), heterotopic ossification at the elbow, necrotising fasciitis and a double toe-finger transfer (Figure 9).

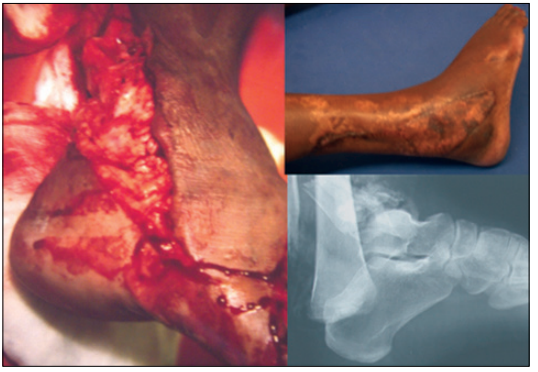


Figure 7 Degloving injury with comminuted ankle fracture, toe to finger transfer, osteosarcoma.

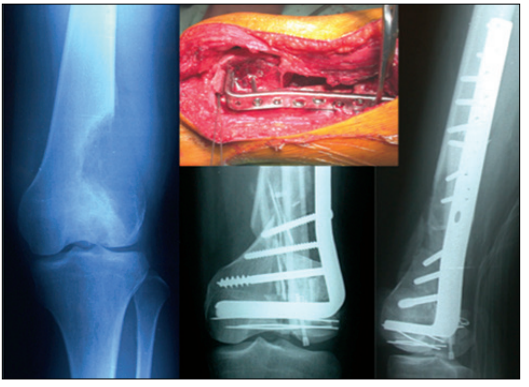


Figure 8 Reconstruction of a distal femur osteosarcoma post-excision and irradiation.

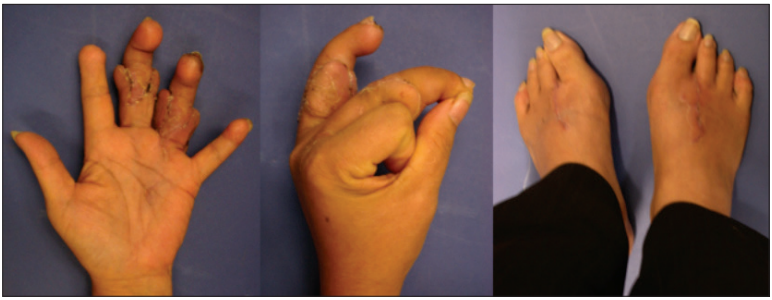


Figure 9 Double toe to finger transfer.

The fellowship finale was a detailed end-posting presentation where stock was taken of all the activities, research done, papers to be written and surgical case involvements. The Fellow also had to comment on what they didn't find useful and how things could be improved. This was a good session to bring things up a notch with each trainee.

Hand Surgery Fellowships: CMKI, Louisville, USA

The fellowship in Louisville started in 2002 and spanned a year's duration. It was more intense, for work started at 6:30am and ended at 8pm. There were many educational activities (morning lectures, pre- and post-operative rounds, the annual flap dissection workshop (Figure 10) and visiting faculty lectures and workshops) which were backed by supporting facilities, such as the microsurgical and cadaveric laboratories set up by the late renowned Professor Dr. Robert Acland, the rotation at Louisville University & Jewish Hospitals and the Indiana offices for clinical attachment. The new CMKI had its own 24-hour hand emergency centre – which was one of a kind (Figure 11).

Figure 10 Dr. Atasoy showing a flap being televised from the cadaveric lab.

Figure 11 The hand ER in the new CMKI.

All fellows (or consultants) were required to do an early morning presentation. Since there were 20 fellows and 10 consultants, each fellow ended up doing 6-8 presentations over the year. This, I found to be a great teaching tool together with the flap dissection workshop which was conducted in the cadaveric lab. The location was in the adjacent University of Louisville Anatomy complex and run by

the renowned late Professor Dr. Robert Acland. Embalmed bodies were kept for dissection and rotated every 6 weeks. A fellow could request for part of a body and use it for whatever they wanted to dissect it for (flaps, arterial supply, innervation etc). Similarly the compulsory microsurgical course which spanned over a week and was supervised by Dr. Robert Acland was considered one of the best in the world. Other teaching activities included various courses and conferences such as the Tri-state (Kentucky, Indiana and Ohio) Hand meeting, the American Society for Surgery of the Hand (ASSH) annual conference and the Synthes Hand course (Figure 12).

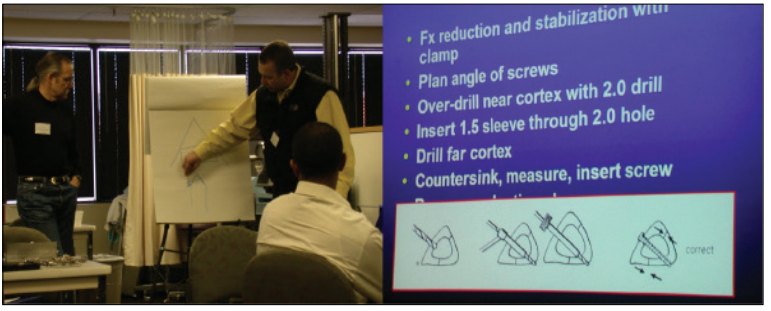


Figure 12 The Indiana Hand course with Hill Hastings.

Hand Surgery Attachments: Institut de la main 2005

The American fellowship training is quite comprehensive but there are certain advantages in the European or British styles, especially for paediatric cases. A number of the American consultants were trained by famous European (paediatric / neuro) hand Surgeons, such as Allieu, Gilbert, Leclercq, Masquelet and Brunelli. The Europeans are ahead of their time in dealing with brachial plexus, congenital and spastic hand cases. Thus I took the opportunity to refine my tendon transfer techniques as well as learn the philosophy

of treatments for some congenital / paediatric cases two years after returning from my fellowships. This is a good way to update oneself and to keep abreast of trends around the world. It also assists us in myriad of ways, from broadening outlooks to widening contact bases and developing long-lasting friendships which are mutually beneficial. This visit also allowed me to develop contacts with some key people in the medical industry through which route I had the opportunity to bring their innovative products to our country.

Hand Surgery Attachments: Institut de la main 2016

My next stint with this famous European institute was during my sabbatical and it was with a specific purpose: to brush up and improve my skill sets with paediatric cases. Professor Alain Gilbert is a maestro in paediatric hand and birth palsies. These are fairly "neglected" in Malaysia, primarily because they come more under the purview of the plastic trained surgeon rather than the orthopaedic trained surgeon. Further, since the majority of hand surgeons in Malaysia are orthopaedic trained, the conclusion is that this area is the less travelled path. Moreover, traditionally brachial plexus birth palsies are bogged with legalities. Thankfully this is on the decline but surgery is now giving marvellous results with the use of new products such as the nerve glue and nerve conduits.

Thus, while generally up to three years after MS Orth is considered sufficient Hand & Microsurgical training, I personally feel that a further one year fellowship overseas attachment is essential as they have adjunct teaching and training not found here. Ideally this should be considered only after acquiring some basic knowledge and practical skills. A two to six weeks attachment every two to three years is ideal to keep oneself updated in the various sub-divisions of hand surgery.

THE FACILITIES – THE COMPONENTS OF A HAND UNIT

The Hand Surgeon's home is actually the workplace, and his home is where he "visits" when not at work! Thus the workplace **must** be made comfortable and the supporting facilities top notch to maximise efficiency and reduce wastage of time due to inferior or inadequate equipment. The mainstay of any decent Hand Surgery Unit or centre would comprise **three parts**: the clinic (with separate dressing rooms), the physiotherapy area and the operation theatre. All of these components cannot be compromised on and ideally should all be in one place or adjacent. Another very important component should be a decent rest area (Figure 13) where the exhausted surgeon can "hang out", and where a 24-hour supply of some sort of food and beverage is available! This becomes very important when cases stretch from a couple of hours into a couple of days.

Figure 13 All the residents / fellows exhausted after a call. I had a couch in my room when doing active calls in my alma mater which proved to be invaluable.

The Operation Theatre

Obviously one of the most happening places is the theatre. The basic "furniture" in the theatre must thus be comfortable for the surgeon is going to spend hours here. Thus the operating table, the surgeon's chair and the "hand table" **must** be in line with the surgeon's specifications. My personal preference is a Stryker stool (Figure 14) and a 2 by 3 foot operating hand table which is translucent so radiographs can be taken easily. Lights must also be bright so that microscopic structures are easily seen.

Figure 14 The Stryker chair is height adjustable with enough padding on the seat to ensure comfort for long surgeries. Hand tables from Lojer are lightweight, easy to attach and can withstand weight even without a supporting leg which facilitates taking a radiograph tremendously.

Figure 15 The (Zeiss®) Operating microscope (left) is absolutely essential for microvascular work and sometimes necessary for nerve repair or schwannoma dissection. The mini C-arm (Orthoscan ®) eases work.

The operating microscope and mini C-arm (Figure 15) are essential to the functioning of a facility catering to emergency cases for the upper limb. Instruments need to be of good quality (Waldemaar LINK) and usually two major and two minor handsets should be in stock and kept sterilised. An electric drill specifically for the hand surgeon's use is quite a basic requirement as are suture materials from 4/0 to 11/0 in various categories depending on the surgeon's preference. Other big ticket items would include the tendon, bone and microsurgical sets (S&T, Stille or KLS Martin), which are a must in any good hand unit. A mini external fixation set would definitely come in handy, where my preference is the LINK Ellis set – which is versatile and easy to use (Roohi SA et al 2009 – poster presented in Poznan, Poland – Figure 16).

Figure 16 Left: The Mini External Fixator for the hand that I find very versatile and easy to apply. Middle: The poster presented in Poland (2009). Right: The Chirobloc – useful innovation.

Last but not least on the wish list would be a wrist arthroscopy set, preferably from Carl Storz, who have one of the best camera systems in the world. With that the major items are covered while smaller items include Kirschner wires, rongeurs, cutters, pliers, the radioluscent "lead" hand from AREX® and finger tourniquets. These are the few other essential things that would be required in a new hospital set-up.

The Clinic

A lot of thought has to go into the layout of the Hand Clinic. It should be designed with the work-flow and the ease of patients in mind. If it is in a public hospital, many rooms would be required and the dressing area may be common and open in concept, separated by curtains. For private hospitals, physical rooms may be partitioned. I was involved in the planning (and construction) of some of the units in the country – the Hand Unit in UKM and the one in the Sunway medical centre among others. Structurally, they are very different but functionally, quite similar.

In both units there are three to four consultation rooms where patients are seen by the registrar or consultant. In Sunway, there are also four dressing rooms. In Louisville, each consultant had six rooms where the fellows saw patients in and the consultant rotated through. Each room would be supplied with its own small custom-made examination table and dressing materials.

The Therapy Area

The therapy area is by far the largest in terms of space, where a brightly-lit open space is inviting and if it has a view, even better. It is important that this area be comfortable and welcoming for the patients would spend anywhere from half an hour to two hours here every alternate day, either before or after surgery. A common therapy table encourages camaraderie and mutual support amongst the patients, although some may prefer privacy. A set of ADL (Activity of Daily Living) boards are very useful to have plus exercise bands, putty and the various tools of the trade. A separate area for splint-making should be set apart. This may be glass walled to allow patients to see their splints being made. It also allows the therapist to keep an eye on the patient while working on something in the room. This area has to be adjacent if not in the same setting as the clinic, so that the surgeon may call on the therapist to discuss options when referring the patient. A minimum of three therapists is good for a busy Hand Clinic. All hand therapists should be well-versed in both physiotherapy and occupational therapy. These go hand-in-hand and are inseparable.

THE FIELD OF HAND AND MICROSURGERY

First, I would like to clarify why the term Hand & Microsurgery is my personal preference – the hand is a small structure which is packed with 19 bones, with numerous ligaments holding them together, a gamut of nerves providing 2 point discrimination of less than 4mm at the fingertips and a myriad of vessels both volar and dorsal supplying the muscles and all the enveloping structures. As one can imagine, injury to these small diameter vessels and nerves (be it traumatic or iatrogenic) requires special repair techniques using the microscope, especially in the digits – one cannot live without the other – they literally go hand in hand!

The beauty of Hand Surgery is in the breadth of cases that we see, ranging from congenital to degenerative, a spectrum across all ages and pathologies, with never a dull moment in the day. I would like to share a few interesting cases I have seen over my past 20 years of experience in this field, which have been life learning lessons for me.

Congenital Cases

Congenital hand cases are challenging, to say the least, for the size of the hand and digit in millimetres is in single digits or sometimes even in fractions! Anaesthesia is also a concern in the very young, especially so if they have syndromic conditions where cardiopulmonary anomalies may be present and potentially life-threatening. We thus work with anaesthetists who are experienced with neonates and infants where the maturity of the lung is of concern, as may arise in patients with brachial plexus birth palsies where we may need to operate in the early window period of three to six months (Gilbert 1991). This category of patients who

are generally not covered by insurance tend to be seen in public hospitals, although coverage by some employers is in practice. Common (congenital) conditions in the hand (Figure 17) are polydactyly, syndactyly, symbrachydactyly, thumb hypoplasia & radial club hand, constriction bands, clinodactyly and camptodactyly (Chong AKS 2010). Macrodactyly (Figure 18) is not that common but is an extremely frustrating condition to treat with generally unsatisfactory results. Further, Clasped thumb may be confused with trigger thumb, which is contested as being congenital and thought of as being acquired.

Figure 17 From L to R: polydactyly, syndactyly, clasped thumb and constriction band syndrome.

Figure 18 Macrodactyly treated twice surgically, but recurred – this is the usual scenario. Further surgeries put the patient at risk of nerve damage. Wise to quit while ahead is my sentiment.

Thumb hypoplasia may occur on its own or with radial deficiency of the forearm (radial club hand) and in the more severe cases ("pouce flottant") may require pollicisation (Figure 19). Convincing Malaysian parents of the necessity of this type of surgery is sometimes an uphill task. I have found that unless it is severe the child adapts quite well and is otherwise functionally competent.

Figure 19 Using Buck-Gramcko's incision to excise the thumb and transfer the index finger to become the 'new' thumb = pollicisation.

Something close to my heart that I have learnt in recent months is managing brachial plexus birth palsies – a challenging condition indeed, in terms of size, philosophical complexity as well as, technical expertise. Under the guidance of Professor Alain Gilbert and his team, we performed reconstructive surgeries on several complete palsies in infants as part of a voluntary team to Ho Chin Minh City Paediatric hospital, in Vietnam (Figure 20).

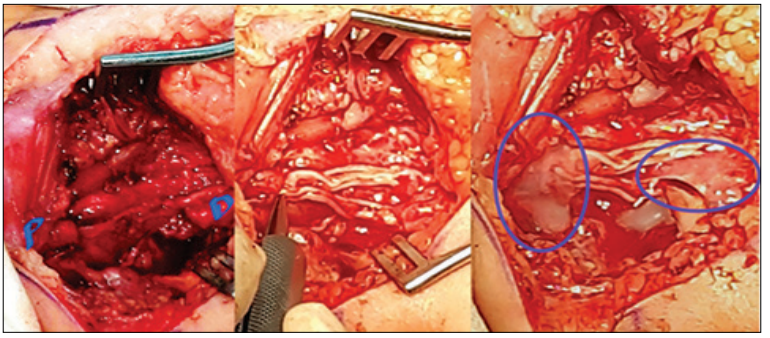


Figure 20 From L to R: After resection of the diseased segment of the lower trunk of the brachial plexus, nerve grafts are put in place carefully and fibrin glue used for repair. Results were good.

The Paediatric Hand

Most paediatric cases we see are trauma related, the most frequent being the notorious fingertip injury. The amputated fingertip is much cause for concern and panic! Often, dealing with the distressed parent is more difficult than handling the child. Thankfully in those less than five years old, there is good news – the amputated part can be sutured back without much deficit. The results are quite good, though it may take up to three months to be visible (Figure 21).

Figure 21 A 3 year old child with a complete amputation of her left ring finger. Simple suturing resulted in good "take" within five weeks.

The older child (more than age six) is treated like an adult, only the healing is much faster (Figure 22). The same technique is still used, but the subcutaneous fat is removed and the remaining "cap" sutured on. The results are just as amazing.

Figure 22 A 10 year old boy with a complete amputation. The subcutaneous tissue is excised, the nailbed is carefully approximated and a fine Kirschner wire is used to compress the bone fragments together (important). The nail plate is slotted in to keep the eponychial fold open.

The incredible healing capacity in children often results in rapid healing but the position of the union may not be ideal. Most times this may not be an issue since remodelling takes care of that too, but in certain cases such as with displaced articular fractures, especially involving the distal radio-ulnar joint (DRUJ), or near the proximal interphalangeal joint (PIPJ), corrective osteotomy and fixation may be required. We have seen teenagers presenting with DRUJ disruption and instability years after the initial trauma (Figure 23).

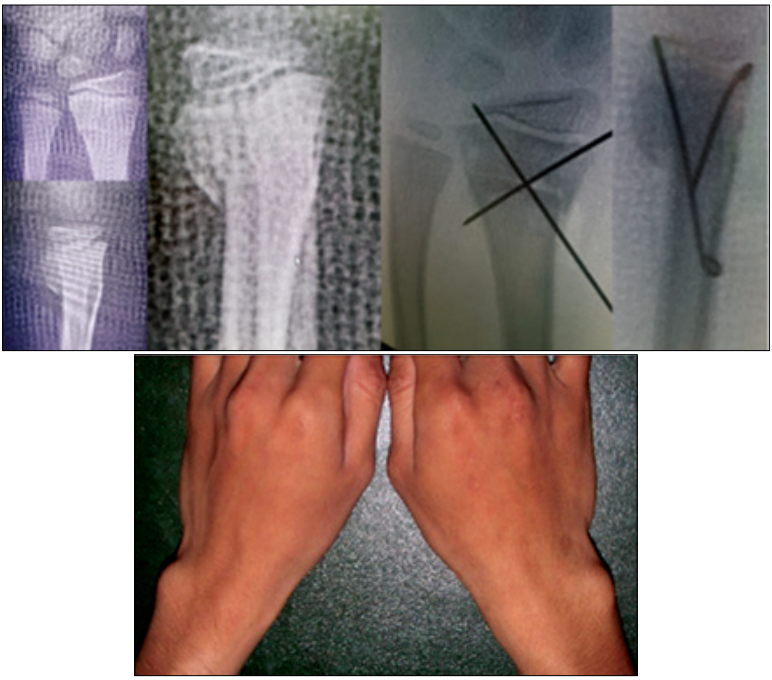


Figure 23 Buckling of the dorsal cortex with increasing volar angulation is a bad sign that needs correction. Note far right that the volar cortex is in correct vertical alignment. L DRUJ instability.

As a rule, non-union is not frequently seen in Paediatric fractures, much less so after surgical intervention – 2-5% after plate osteosynthesis – as cited by Looi CSK et al. (2017). If it does occur, however, a few pointers to uphold are: meticulous handling of tissue, perfect bone graft opposition with host bone, drilling of recipient medulla followed by rigid fixation. In one case we used the anterior tibial cortex as a strut graft to bridge the Ulna non-union (Figure 24: Looi CSK et al. 2017).

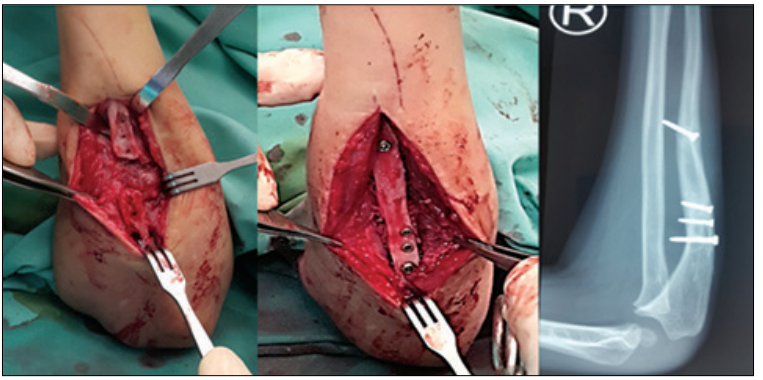


Figure 24 From L to R: Bone gap of more than 6cm bridged with Tibial strut graft. Union finally seen.

Paediatric hand injuries that were seen frequently in the emergency room of an urban hospital consisted of tendon injuries (24%), amputations (20%), laceration wounds (16%) and fingertip injuries (16%) (Shalimar, A. et al. 2007). In a two year review of all paediatric hand injuries, half were found to occur in the home setting while almost 20% were due to motor vehicle accidents with an increased incidence observed during school holidays (Figure 25).

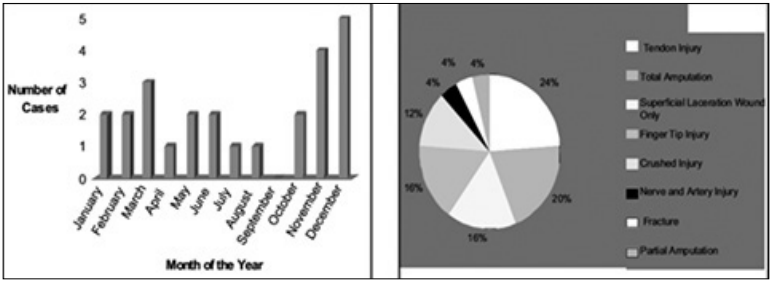


Figure 25 Peaks are seen for the months of March, June and December. The types of injuries are shown in the pie chart.

Meanwhile an interesting trend of festive-related injuries is also seen in our country. While we are aware of firecracker injuries sustained to the hand and face of children, sugarcane extraction machine injuries are also seen, particularly during the fasting month of Ramadan. Children assisting their parents who sell sugar cane juice in the Ramadan bazaar are particularly likely to sustain this devastating injury which results in a mangled hand which is beyond repair and susceptible to *Pseudomonas infection* (Ahmad SR 2015). Education and prevention are the best solutions and this has been highlighted in the newspapers (Figure 26: Star On line 2014).

Figure 26 Sugarcane accidents in bazaars. A mangled hand due to the sugarcane machine.

Trauma to the Hand and Upper Limb

This forms by far the largest segment of cases seen in hospitals, either directly after the event or later when the patient realises it is something more major. The topic is very vast and there are extensive descriptions of fractures, but much less on ligamentous injuries of the digits. A detailed description of the latter has been given in

the book by Ian Trail and Andrew Fleming in the chapter Acute Thumb and Finger Instability (Figure 27: Roohi SA and Caroline Leclercq 2015).

Figure 27 Chapter in the book by Ian Trail and Andrew Fleming.

An unusual but interesting form of injury is that sustained due to the use of paint guns and, less frequently, hand nail guns (Figure 28). The former is extremely toxic and may even result in amputation of the digit if not treated promptly. A thorough washout of the digit must be undertaken to remove as much paint as possible from the finger.

Figure 28 Although this looks minor, looks can be deceiving for the inside paints a different picture! The nailgun injury is harmless in this case.

Another area of trauma that is oft overlooked but is extremely important is *Crush Injuries of the Hand* as opposed to the crush syndrome (Roohi SA, Pho RWH 2018). All trauma has some amount of crush involved, be it a sharp knife or a blunt force trauma. The former has a greater pressure applied (Force per unit area) due to its sharp infliction. A printing press would have greater element of crush since a high force is applied over a wider area causing "burst lacerations". Care must be taken during debridement for the muscle is usually not viable and has to be excised to prevent infection from occurring (Figure 29).

Figure 29 Crush injury due to printing press. It is imperative that the ink staining is removed prior to assessment of circulation as well as muscle viability.

The other form of crushing that is not visible is that which occurs in a degloving injury – the skin and subcutaneous tissue are sheared off by a rotational force applied in opposing direction (roller injury), avulsing the blood vessels and causing severe ischaemia (Figure 30).

Figure 30 A degloving injury caused by rollers resulting in Volkmann's ischaemic contracture.

One of the most oft seen in the emergency section is amputations of the limb – fortunately this is rare (Figure 31). Swift action is required to salvage a major amputation since the muscle is not able to withstand loss of blood supply (warm ischaemia time of 2 hours).

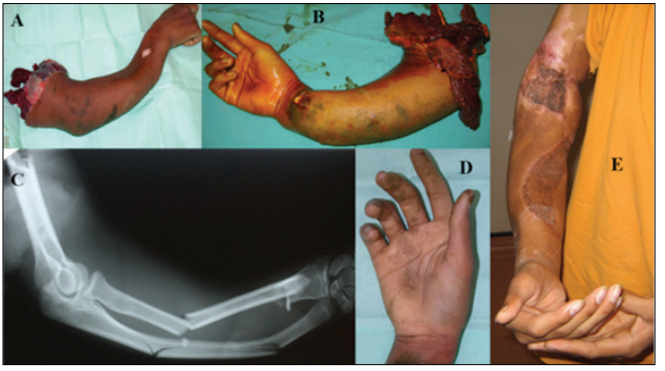


Figure 31 A 17 year old sustained a complete amputation of his right arm at the proximal humeral level. He was immediately rushed into the operating room within half an hour of arrival. The limb was saved and he regained good function after 1 year.

Adult Brachial Plexus injuries are serious cause for concern. They still occur too often and are mainly due to motorcyclists having accidents at high speeds. Associated injuries may include bilateral first rib fractures (Ismail I et al. 2017), vascular injuries and other limb fractures (Figure 32). Having treated a patient with 13 fractures in one limb along with a complete brachial plexus injury, it can be a taxing journey! The sad part is that no matter how good the reconstructive surgery, the functionality is never the quite the same. Perhaps future advances in regenerative therapy may improve outcomes.

Figure 32 A young male motorcyclist with extensive bruising over the left anterior chest wall highly suggestive of a brachial plexus injury and first rib fractures. The cervical x-ray shows the latter as well as a transverse process fracture of C7.

Infection

There are many types of infections that we see in our daily practice but here I would like to highlight some that are unusual and difficult to diagnose, because they are easily missed. First and foremost is Tuberculosis of the hand and wrist (Roohi SA 2010). Those that present with signs of inflammation are not as challenging as those who do not. For example, a patient presented vague pains over the left wrist for over 5 years. A plain x-ray revealed a lytic lesion in the distal Radius and Ulna (Figure 33). Chemotherapy was commenced after curettage.

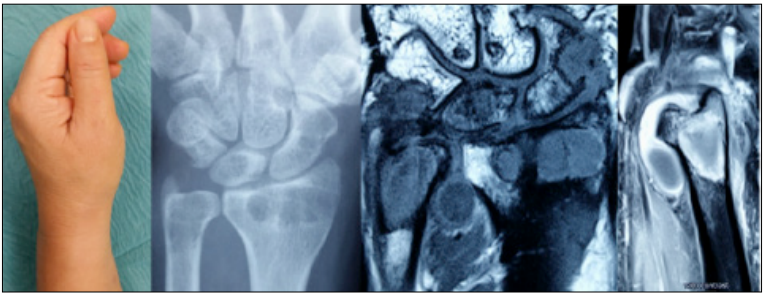


Figure 33 A 50 year old well-travelled male presented with pain and mild swelling over his left wrist. Massive amounts of synovitis and tissue removed at surgery revealed tuberculosis infection.

Dangerous bacterial infections to note are necrotising fasciitis (Figure 34) and diabetic flexor tenosynovitis. Both have a high chance of causing loss of limb and life. We have studied Diabetic Hand Infections in a University and government hospital and found that 80% of the patients had it in their dominant hand and that a big number (40%) end up with amputations, mainly because they present late (Balakrishnan V 2006 Thesis).

Figure 34 From L to R: Skin and subcutaneous tissue is lost at a rapid rate. Early debridement managed to salvage the limb. Flexor tenosynovitis showing splaying of the digits and flexed posture of the ring finger (affected) which also needed urgent drainage and where consent must always be taken for future amputation. This conveys the seriousness of the condition.

Viral warts are another entity that are missed or misdiagnosed. Most are fairly easily treated with local salicylate application but some require surgical excision (Figure 35).

Figure 35 Usually a "kissing" lesion of the viral wart is seen.

Tumours

There are numerous bony and soft tissue tumours in the hand and upper limb. I shall touch on some interesting cases that I have come across in my practice. In 2003 upon returning from my fellowships, we were confronted with a patient with a highly aggressive malignant peripheral nerve sheath tumour (Figure 36: MPNST). The tumour was excised twice but recurred rapidly and the patient passed on within a year. Lesson to be learnt is to treat these with extreme caution and respect.

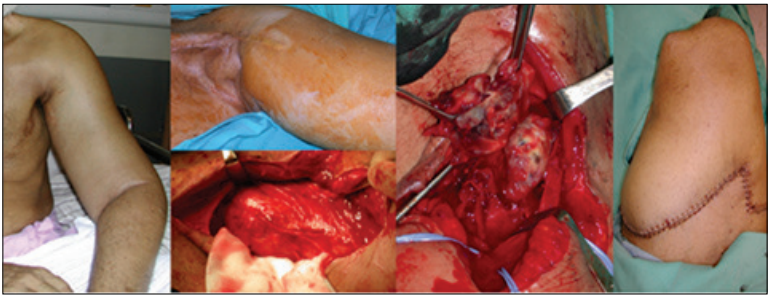


Figure 36 Extreme pain and swelling of left arm with recurrence. Large tumour was excised. Second surgery was a gleno-humeral disarticulation. Patient died a year after initial diagnosis.

The second case was also a malignant tumour (Acral Myxoid Inflammatory Fibroblastic sarcoma) of the right (dominant) thumb but with a better outcome (Figure 37). An amputation was carried out after an incisional biopsy was done and although we tried to save the thumb, the tumour was very aggressive and had already infiltrated the bone, and thus had to be excised. She is now eight years post-op and recurrence free.

Figure 37 Amputation of right thumb for a sarcoma, patient is disease-free.

The third type of tumour is not as severe as the previous ones but is very often missed leading to delayed diagnosis and significant morbidity in terms of pain and discomfort. This is the glomus tumour that occurs at the periphery of digits and usually resides in the fingernail (Figure 38). Pin point pressure at the discoloured area elicits pain and is pathognomonic of it.

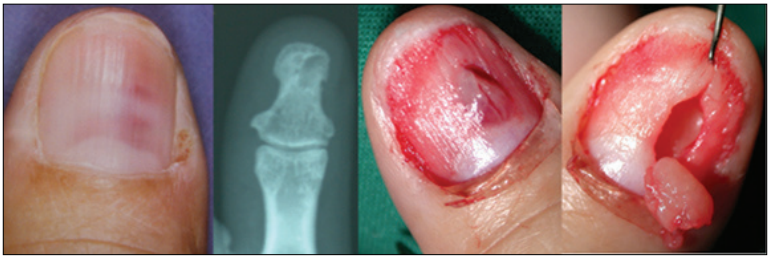


Figure 38 Vague bluish discloloration and lytic lesion on x-ray. The nail plate is elevated and the tumour removed in toto.

Last but not least, I would like to highlight vascular tumours; for example the huge dorsal soft tissue swelling on the left thumb of an eight year old boy. The defect post-excision was so big that a flap needed to be designed to cover it (Figure 39). Another example is a venous malformation in the left forearm of a 10 year old girl – the infiltration was so extensive that the ulna had to be excised and a one bone forearm created (Figure 40).

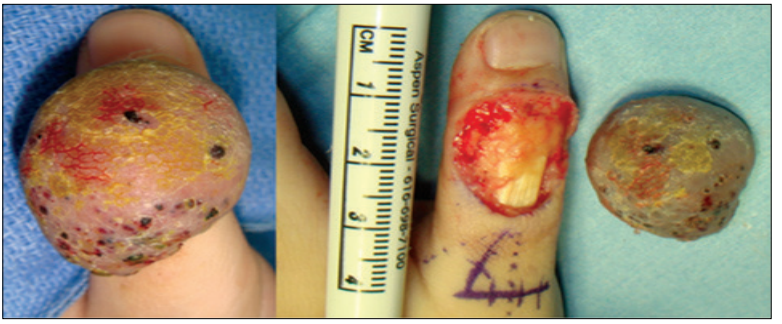


Figure 39 A large vascular tumour for which a rotation flap sufficed post-excision.

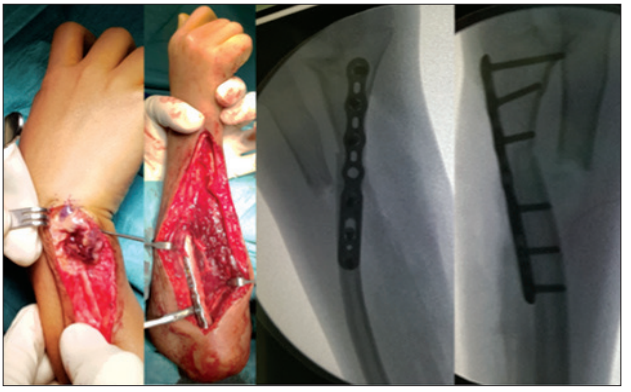


Figure 40. Excision of a venous malformation which had 'eaten into' the distal ulna. This was excised and the proximal end fixed to the distal radius – creation of an 'ulnius'.

A Tumour can also mimic common hand conditions such as carpal tunnel and trigger finger! In one instance a metastasis from an adenocarcinoma settled in the wrist and caused carpal tunnel which was not relieved post release (Roohi SA 2011). Upon open release, the tumour was found! In another patient, the triggering was found to be due to a giant cell tumour and a "recurrence" after percutaneous release prompted open release (Rahimawati, N. 2010). Thus recurrence with minimal incisions may be deceiving. It may not be due to inadequate release but due to another cause.

Reconstructive Surgery

This area of Hand & Microsurgery seems to be declining due to the rising cost of microsurgical reconstruction. The long and demanding hours that need to be put in and the (monetary) rewards in the private and now financially driven public sector have pressured its demise. As for my practice, I used to perform at least one free flap every month, at times two. However, I have not done any in the last 6 months.

Some of the free flaps I have done and feel are useful are: the lateral arm flap, the antero-lateral thigh flap, the toe to finger transfer and the groin flap. I will show the thigh flap for an amputation at the wrist level which was done secondarily after the patient was received 24 hours post-trauma (Figure 41).

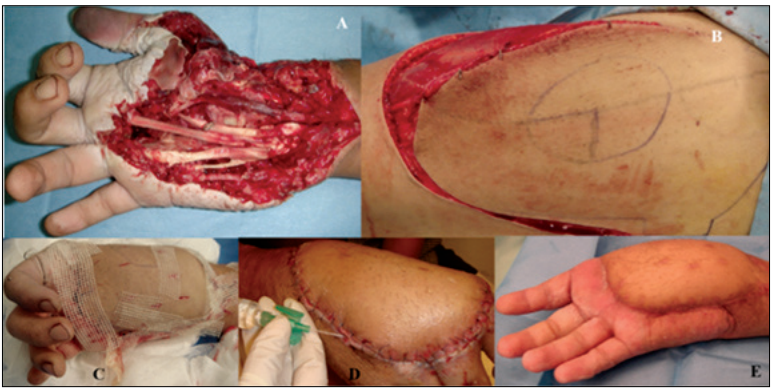


Figure 41 A: A 30 year old Army captain had a roll over injury in his car and hit a metal divider which all but severed his right hand at the radio-carpal level. He was sent in 24 hours later. Revascularisation, Debridement and tendon repair were performed at 24 hours post-trauma and held with Kirschner wires. An external fixator was destroyed by infection and the thenar muscles became necrotic. However, the thumb ray was only amputated after a delay in consent of 5 days. B, C: A free lateral thigh flap was performed to cover the defect and D: the battle with infection was finally won a year later. E: He felt "functional" although he had lost his thumb and did not want a pollicisation.

Local and rotational flaps can be extremely helpful too. Other than the usual, the "cap reattachment" for fingertip injuries (Figure 42) and the Ostrowski flap (Figure 43) are the most useful to have in one's armamentarium.

Figure 42 The collage is self-explanatory. Meticulous technique is essential.

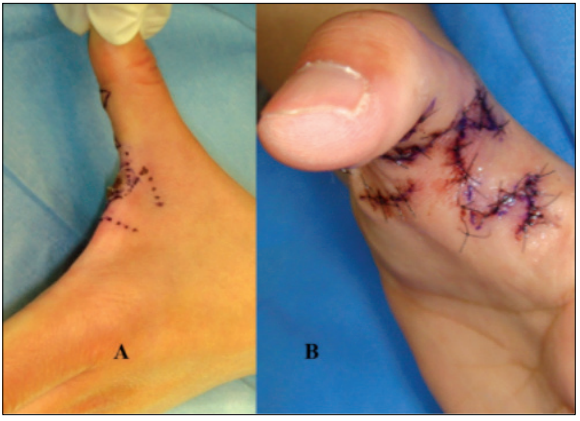


Figure 43 This flap specifically designed for the first web-space is simple yet ingenious.

Research

My research has been in varied areas, from epidemiology (the prevalence of the Palmaris tendon in the Malaysian population – SA Roohi 2007 and Epidemiology of Distal Radius Fractures in a District Hospital & Their Treatment – Poster MOA 2009) to anatomy (The role of Flexor Carpi Radialis in the anatomy of the

Distal Radius Fracture – awaiting publication) to finding out what affects vascular repair and the haemodynamics of blood vessel primary repair and vein graft (end to end and end to side) together with researchers from the University of Perlis (MN Rahman et al. 2012, 2013). It also includes studies on possibilities of veins being used as neural conduits (Hassan NH et al 2012) and Sciatic nerve repair with Olfactory ensheathing cells (Tan CW et al. 2013). In terms of regenerative medicine, the use of heparan sulfate was extremely useful in collaboration with Professor Denis Barritault from the University of Paris (Ahmad SR, 2015 and another journal article accepted for publication in Clinical Case Reports by Wiley.

The current research work has yielded some very exciting results on the use of stem cells in fracture healing on goat tibiae. Results will be published soon, so keep an eye out for them!

THE FUTURE – IS PROMISING!

Presently, treatment in Orthopaedic surgery is mainly by physical means: reduction of fractures, repair of nerves and vessels and coverage with flaps. Even these areas have shown rapid development with the discovery of innovative flaps and advances such as supermicrosurgery and perforator flaps.

In terms of equipment we will be seeing a torrent of new items from the big machines to the smallest cannulated screw in absorbable materials. The titanium plates may be replaced by vanadium or some other alloy and their sizes will gradually get smaller and more refined. As the distal radius plates acquire a lower profile and great tensile strength, it eliminates the need for bone graft, but the surgeons may not be ready to let that go just yet. Or perhaps there may be alternatives to the traditional bone graft?

Perhaps in the future we may not even need bone grafts – we may develop enhancers to hasten the rate of healing in terms of cellular therapy. Indeed fracture healing has already been sped up in countries like Korea with the use of various applications of stem cells.

I do believe the use of biologics is going to be the next leap forward. Regenerating agents like heparan sulfate and glycosaminoglycans are also in the forefront and showing encouraging results. We shall just have to wait and see.

CONCLUSION

Hand & Microsurgery is an exciting area of medicine which is growing by leaps and bounds. It gives the practitioner a variety of possible areas to practice, to suit the individual, and allows an array of cases in one's portfolio so that it is always exciting.

The developments in this area, in mechanical, chemical and biological terms, are mind-boggling and we have not even touched on the neuro-medical area, in terms of prostheses. With neuro-modulation, the possibilities for amputees and paraplegics are incredible. It is indeed an exciting time to be in.

REFERENCES

Ahmad S.R. (2015). Sugarcane extraction machine injuries of the hand. BMC Proceedings, *9*(Suppl 3), A104.

Ahmad S.R. (2015). Use of regenerative agents in hand surgery. BMC Proceedings, *9*(Suppl 3), A103.

Alpenfels E.J. *(1955)*. The anthropology and social significance of the human hand. O&P Library, *Artificial Limbs, 2*(2), 4-2*1*.

Badash I, Gould D.J, & Patel K.M. (2018). Supermicrosurgery: History, applications, training and the future. *Front Surg*, *21*(5), 23.

Balakrishnan V., Naicker A.S., Seto B.C., Moissinac K., Mahesan S., Omar M., & Roohi S.A. (2006). *Upper Extremity Infections in patients with Diabetes Mellitus*. Thesis for Masters in Orthopaedics UKM.

Chong A.K.S. (2010). Common congenital hand conditions. *Singapore Med J, 51*(12), 965-970.

Gilbert A., Brockman R., & Carlioz H. (1991). *S*urgical treatment of brachial plexus birth palsy. *Clin Orthop Rela*t *Res.,* (264), 39-47.

Green S.A. (2013). Giants in orthopaedic surgery: Sterling Bunnell MD. *Clin Orthop Relat Res. Dec. 471*(12), 3750–3754.

Hand Surgery: Wikipedia. https://en.wikipedia.org/wiki/Hand_surgery

Hassan, N.H., Ahmad Fadzli Sulong, Min-Hwei Ng, Ohnmar Htwe, Ruszymah B. H. Idrus, Sharifah Roohi, Amaramalar S. Naicker & Shalimar Abdullah. (2012). Neural-differentiated mesenchy*mal stem cells incorpo*rated into muscle stuffed vein scaffold forms a stable living nerve conduit. *J of Orthop Research 30*(10), 1674-1681.

http://www.mssh.org.my/content.php?PagesID=2

https://en.wikipedia.org/wiki/Microsurgery

Ismail I., Looi C.S.K., Hakim A.B., & Roohi S.A. (2017). Bilateral First rib and associated lower cervical spine fractures. *MOJ Orthop Rheumatol 7*(5), 00287.

Kleinert H.E., & Kasdan M.L. (1963). Restoration of blood flow in upper extremity injuries. *J Trauma, 3*(5), 461–76.

Koshima I., & Soeda S. (1989). Inferior epigastric artery skin flaps without rectus abdominis muscle. *Br J. Plast Surg 42*(6), 645–8.

Looi C.S.K., Roohi S.A., & Gill R.S. (2017). A case of ulna fracture non-union managed with tibial strut cortico-cancellous bone grafting *in a p*aediatric patient. *Journal of Hand Surgery (Asian Pac), 22*(3), 396-402.

Ostrowski, D.M.1., Feagin, C.A., *& Gould,* J.S. (1991). A three-flap web-plasty for release of short congenital syndactyly and dorsal adduction contracture. *J Hand Surg Am., 16*(4), 634-41.

Rahimawati, N., Roohi S.A., Naicker, A.S., & Zanariah, O. (2010), Giant cell tumour of tendon sheath masquerading as trigger finger. *Malaysian Orthopaedic Journal, 4*(3), 37-40.

Rahman, Y.M.N., Shahriman, A.B., Za'aba, S.K., Roohi, S.A. & Khairunizam. (2013). Theoretical approach on vein graft survival: Simulation on vein graft. *International Journal of Medical Engineering and Informatics, 5*(4), 279-288. (DOI: 10.1504/IJMEI.2013.057180) .

Rahman, Y.M.N., Shahriman, A.B., Za'aba, S.K., Roohi, S.A. Khairunizam, & Ismail, A.H. (2012). Hemodynamic Study on Upper Extremity: Simulation on Straight Reverse Saphenous Vein Graft. International conferenc*e* on Biomedical Engineering (ICoBE), 27-28 February, Penang © *I*EEE 2012.

Roohi, S.A. & Leclercq C. (2015). Acute ligamentous instability of the finger and thumb joints. Chapter *14*, 305-312. Disorders of the Hand and Wrist. Ed Ian Trail and Andrew Fleming. Springer Verlag UK.

Roohi, S.A. (2010). Chronic tuberculous infections of the hand and wrist. Chapter 14:305-312. Hand Surgery Worldwide: International Reconstruction of a Beautiful and Ready Instrument of the Mind. Ed James R Urbaniak. Saunders Ltd. USA

Roohi, S.A., Choon-Sian, L. A., Shalimar, Tan, G.H., & Naicker, A.S (2007). A study on the absence of palmaris longus in a multi-racial population. *Malaysian Orthopaedic Journal, 1*(1), 26-28.

Roohi, S.A., Samsudin, O.C., Shukur M.H., & Ibrahim, S. (2011). Metastatic adenocarcinoma of the hand presenting as carpal tunnel syndrome: A report of an unusual case. *Malaysian Orthopaedic Journal. 5*(1), 15-19.

Roohi, S.A., Zanariah, O., Ohnmar, H., & Naicker, A.S. (2009). Use of Mini External Fixator in Hand Fractures. Poster Presentation in June, FESSH, Poznan, Poland.

Roohi, S.A., Zanariah, O., Tan, C.W., Nurliyana, A., Mohd Farhan, M.N., Rampal, L, Hamid, A.R, & Naicker, A.S. (2009). Epidemiology of Distal Radius Fractures in A District Hospital *&* Their Treatment. Poster Malaysian Orthopaedic Association.

Roohi S. A., & Pho R.W.H.(2018). Crush injuries of the hand, Essentials of Hand Surgery, Alexandro Aguilera Salgado, IntechOpen, DOI: 10.5772/intechopen.76658. Available from: https://www.intechopen.com/books/essentials-of-hand-surgery/crush-injuries-of-the-hand-part-i-history-mechanism-and-pathomechanics

Sade, R.M. (2005) Transplantation at 100 Years: Al*e*xis Carrel, Pioneer Surgeon. *Ann Thorac Surg, 80*, 2415-8.

Sara Ahmad, T. (2011). History of hand surgery in Malaysia. Chapter 28:133-138. Hand Surgery Worldwide: International Reconstruction of A Beautiful and Ready Instrument of the Mind. Ed James R Urbaniak. Saunders Ltd. USA.

Shalimar, A., Jamari, S., Abd*ul Halim, A.R., Roohi, S.A.,* N*a*icker, A.S., & Sharaf, I. (2007). A 2-year demographics study of domestic paediatric hand *injuries requir*ing surgical Iintervention in an urban hospital. *Malaysian Orthopaedic Journal, 1*(1), 34-38.

Star On Line Sunday 29 June 2014: https://www.thestar.com.my/lifestyle/family/.../2014/06/.../beware-sugarcane-accidents...

Susumu Tamai. (2009). History of microsurgery in plastic and reconstructive surgery 2009 DEC. *124*(6S), e*28*2-e294,

Tan, C.W., Ng M.H., Ohnmar, H., Lokanathan, Y., Nur-Hidayah, H., Roohi, S.A., Ruszymah, B.H.I., Nor-Hazla, M.H., Shalimar, A., & Naicker, A.S. (2013). Sciatic nerve repair with tissue engineered nerve: Olfactory ensheathing cells seeded poly (lactic-co-glygolic acid) conduit in an animal model. *Indian Journal of Orthopaedics, 47*(6), 548-552.

Taylor, G.I., & Palmer, J.H. (1987) The vascular territorie*s* (angiosomes) of the body: Experimental study and clinical applications. *Br J Plast Surg, 40*(2),113–41.

Wardrop D., & Keeling D. (2008) The story of the discovery of heparin and warfarin. *Br Jn of Haematology, 141*, 757-63.

BIOGRAPHY

Roohi Waseem was born in Assunta Hospital, Petaling Jaya. Her late Father, Syed Waseem Ahmad was a Professor of Economics at University Malaya while her mother taught domestic Science and was subsequently a homemaker. Roohi attended primary schools in Kuala Lumpur (Alice Smith School), Boston (Runkell School) and Karachi (Karachi Grammar School), and Secondary schools in Kuala Lumpur (Garden School) and Karachi (St. Joseph's College), adding a varied flavour to her education. She speaks five languages (English, Malay, Urdu, French and German) and was the top student in her Secondary School, enabling her to further her studies in Singapore (National Junior College). She was accepted to Princeton, Yale and Aga Khan Universities but decided that she wanted to pursue medicine closer to home. She was accepted into Universiti Kebangsaan Malaysia (UKM), and graduated with an M.D., amongst the top ten, in 1990.

Dr. Sharifah Roohi did her housemanship in HKL in General Surgery, Orthopaedics and Obstetrics & Gynaecology and was subsequently posted to Pahang, Kuantan, where she requested to be in Internal Medicine, thinking that she might want to pursue Emergency Medicine. She was then posted to Bentong for four years where she saw first-hand and learned in depth about the country's health service. She even managed to pick up enough Cantonese to elicit a patient's medical history and lived life in the slow (but enjoyable) lane! Not one to stay idle for long, she got involved in a nationwide research programme on drug resistance in Malaria (Lokman et al.), which landed her her first publication. Not being where the action was however propelled her to resign and work in the Emergency department for a while to gain experience, after which she applied to rejoin her alma mater.

After some trials, she joined the four year UKM Orthopaedics Master's programme in June 1996. While in HKL, after undergoing her Hand & Microsurgery rotation, she qualified as a top student in the FRCS (Edinburgh) examinations held in UM in 1998. A unique situation resulted whereby she was taken in as a lecturer in early 1999, while still in the third year of her Masters, which she completed in 2000, ranking among the top three. She has the distinction of being one of only two women in the whole country holding both the FRCS and a Masters of Surgery in Orthopaedics postgraduate degrees.

She was targeted to establish the Hand Unit in UKM which was a challenging task. In order to be better able to do this, she embarked on training at the Hand & Reconstructive Microsurgery Unit, Orthopaedics department, National University Hospital, Singapore for six months, training under Professor Dr. Robert Pho Wan Heng and Associate Professor Dr. Lim Beng Hai. After a two month break she flew to Louisville, Kentucky, to the Mecca of Hand Surgery: the Christine M. Kleinert Institute, where she completed a one year clinical fellowship in Hand & Microsurgery. There she trained under 10 senior consultants: Drs Kleinert, Kutz, Atasoy, Tsai, Wolff, Breidenbach, Scheker, Gupta, McCabe, and Shatford, and two new ones: Napolitano and Özyurekoglu, who had just joined. It was a packed fellowship with trauma calls and elective surgeries with working hours from 6:30 in the morning to to 8pm at night, a good bed of preparation for what was soon to come.

Upon her return to Kuala Lumpur, she set up the Hand Unit in the department of Orthopaedics & Traumatology in HUKM (the first to be officially established in a University) and started a marathon of daily calls for the next three and a half years! It compressed the learning curve of 10 years into a short span of three years, which manifested in her being the top candidate for the International

Federation of Societies for Surgery of the Hand (FESSH), European Examination, which was opened up to the world for the first time in June 2008.

In November 2006, Sharifah Roohi joined FPSK, UPM, as an Associate Professor and was soon tasked to set up the Masters in Surgery (Orthopaedics) programme. Shifting through mountains of documents and with a reliable partner in crime, Dr. Zanariah Othman, the final document was made ready in 2012, about the same time that Dr. Roohi was made Head of the Department of Orthopaedics. In August of 2013, she was promoted to full Professor. In 2015, the first batch of Masters students were taken in and presently they are in their final year.

During her tenure as the Head, she developed the Department of Orthopaedics from less than 10 members to 14 and established seven sub-specialty units. During this time, she was also actively involved in the Library committee, the Ethics Board, the HPUPM committee and the Curriculum committee, amongst others. She is an international member of many professional bodies and is licensed to practice in four countries. She held the post of Honorary Secretary of the Malaysian Orthopaedic Association in 2007 as well as currently (2018). She was the President of the Malaysian Society for Surgery of the Hand (MSSH) from 2010 to 2015 and chaired the Asian Pacific Federation of Societies for Surgery of the Hand (10th APFSSH) Congress held in Kuala Lumpur in October 2014. She has been a keynote and plenary speaker in international as well as national conferences and has travelled world-wide as an invited speaker. She is also well known in lecturing and conducting courses in and around the country. She has authored many articles in books and journals, totalling about 50 and is a reviewer for more than 10 journals (international and national). She has held various grants and has collaborated with many national and international companies,

institutions and universities. In 2016, during her sabbatical she undertook a two month attachment with the Institut de la main in Paris ending with a charity mission to Ho Chin Minh City, Vietnam, as part of a voluntary team of surgeons and anaesthetists, to perform operations on the paediatric population with birth palsies and defects. Prof. Dr. S. Roohi has also been a member of the esteemed Malaysian Medical Council and is presently a member of the Writing Group for the National Orthopaedic Curriculum Committee.

Dr. Roohi loves to travel but when she is not working (very rarely) she enjoys staying at home and relaxing with a good book in hand (pun intended). Her pillar of strength is her mother who has been her gladiator whilst her late father was her champion. She looks forward to many more productive years with several interesting projects in mind – both charitable and profitable!

ACKNOWLEGEMENTS

In the name of Allah, the Most Gracious, the Most Merciful, the Most Knowledgeable…

Alhamdulillah, all praise to Allah for enabling a healthy, active and meaningful journey of life… and allowing me to share my experience in the form of this lecture and book.

The publication of this book would not be complete without acknowledging the tremendous amount of effort that went into it as well as in the preparation of the Inaugural Lecture.

Firstly, I would like to thank Dr. Zanariah Othman and Prof. Dr. Azhar Md Zain for taking me in and giving me the opportunity to serve in UPM. I have had a good twelve years which did not feel like work! I would also like to thank the past (and present) Heads of Department of Orthopaedics: Dato' Dr. Selva Kumar, Dr. Zanariah and Prof. Manohar Arumugam for all the suggestions, help and advice extended.

I would also like to express my sincerest gratitude to Prof. Dr. Norlijah Othman who guided me throughout my tenure as a Head of Department and from whom I learnt a lot! A note of thanks too to Prof. Dato' Dr. Abdul Jalil Nordin as well as the present Dean, Prof. Dr. Zamberi Sekawi, for all the encouragement and tremendous support shown.

To my fellow colleagues in the department, I would not be where I am today without your support and encouragement. To the administrative staff, I cannot even begin to thank you for all your immeasurable assistance over the years, especially not forgetting Puan Noraida and Puan Zuraida, both of whom are no longer with the department.

Most importantly, to my teachers and Professors near and far from UKM, UM, Singapore, France and the USA, I have learned so much from all of you, I appreciate your time, effort and commitment sincerely, may Allah swt grant you the rewards. Special mention to my local mentors in Hand Surgery: Dr. Ranjit Singh Gill and Dato' Dr. V. Pathmanathan as well as Sister Foong Shin Har – I would not be where I am today without the knowledge and experience imparted by you.

To my students, undergraduate (UKM, UPM and Monash) and postgraduate (in UPM, UKM, UniMAP), I record my heartfelt appreciation and gratitude for your invaluable contributions in research and publications. To my collaborators in the Veterinary Faculty, I salute you and admire your dedication in treating those who cannot speak. You have taught me much in humility, service and kindness in care. To my international collaborators and the medical industry, without which we would not be able to do some of our best work, a big thank you. As for my patients, I would not be where I am today if you had not come to me for treatment – thank you for putting your trust, your health and your life in my hands.

Finally, I would like to thank my Mom, Samdani Waseem binti Noorullah, who patiently awaits my return from work and encourages me every step of the way. To my late father, Syed Waseem Ahmad who encouraged me to study and study and continue to further my studies… may Allah swt bless you and reserve a place for you in Jannah. We are all learners in this life: let us live, love and learn to leave a legacy.

LIST OF INAUGURAL LECTURES

1. Prof. Dr. Sulaiman M. Yassin
   The Challenge to Communication Research in Extension
   22 July 1989

2. Prof. Ir. Abang Abdullah Abang Ali
   Indigenous Materials and Technology for Low Cost Housing
   30 August 1990

3. Prof. Dr. Abdul Rahman Abdul Razak
   Plant Parasitic Nematodes, Lesser Known Pests of Agricultural Crops
   30 January 1993

4. Prof. Dr. Mohamed Suleiman
   Numerical Solution of Ordinary Differential Equations: A Historical Perspective
   11 December 1993

5. Prof. Dr. Mohd. Ariff Hussein
   Changing Roles of Agricultural Economics
   5 March 1994

6. Prof. Dr. Mohd. Ismail Ahmad
   Marketing Management: Prospects and Challenges for Agriculture
   6 April 1994

7. Prof. Dr. Mohamed Mahyuddin Mohd. Dahan
   The Changing Demand for Livestock Products
   20 April 1994

8. Prof. Dr. Ruth Kiew
   Plant Taxonomy, Biodiversity and Conservation
   11 May 1994

9. Prof. Ir. Dr. Mohd. Zohadie Bardaie
   Engineering Technological Developments Propelling Agriculture into the 21st Century
   28 May 1994

10. Prof. Dr. Shamshuddin Jusop
    Rock, Mineral and Soil
    18 June 1994

11. Prof. Dr. Abdul Salam Abdullah
    Natural Toxicants Affecting Animal Health and Production
    29 June 1994

12. Prof. Dr. Mohd. Yusof Hussein
    Pest Control: A Challenge in Applied Ecology
    9 July 1994

13. Prof. Dr. Kapt. Mohd. Ibrahim Haji Mohamed
    Managing Challenges in Fisheries Development through Science and Technology
    23 July 1994

14. Prof. Dr. Hj. Amat Juhari Moain
    Sejarah Keagungan Bahasa Melayu
    6 August 1994

15. Prof. Dr. Law Ah Theem
    Oil Pollution in the Malaysian Seas
    24 September 1994

16. Prof. Dr. Md. Nordin Hj. Lajis
    Fine Chemicals from Biological Resources: The Wealth from Nature
    21 January 1995

17. Prof. Dr. Sheikh Omar Abdul Rahman
    Health, Disease and Death in Creatures Great and Small
    25 February 1995

18. Prof. Dr. Mohamed Shariff Mohamed Din
Fish Health: An Odyssey through the Asia - Pacific Region
25 March 1995

19. Prof. Dr. Tengku Azmi Tengku Ibrahim
Chromosome Distribution and Production Performance of Water Buffaloes
6 May 1995

20. Prof. Dr. Abdul Hamid Mahmood
Bahasa Melayu sebagai Bahasa Ilmu-Cabaran dan Harapan
10 June 1995

21. Prof. Dr. Rahim Md. Sail
Extension Education for Industrialising Malaysia: Trends, Priorities and Emerging Issues
22 July 1995

22. Prof. Dr. Nik Muhammad Nik Abd. Majid
The Diminishing Tropical Rain Forest: Causes, Symptoms and Cure
19 August 1995

23. Prof. Dr. Ang Kok Jee
The Evolution of an Environmentally Friendly Hatchery Technology for Udang Galah, the King of Freshwater Prawns and a Glimpse into the Future of Aquaculture in the 21st Century
14 October 1995

24. Prof. Dr. Sharifuddin Haji Abdul Hamid
Management of Highly Weathered Acid Soils for Sustainable Crop Production
28 October 1995

25. Prof. Dr. Yu Swee Yean
Fish Processing and Preservation: Recent Advances and Future Directions
9 December 1995

26. Prof. Dr. Rosli Mohamad
Pesticide Usage: Concern and Options
10 February 1996

27. Prof. Dr. Mohamed Ismail Abdul Karim
Microbial Fermentation and Utilization of Agricultural Bioresources and Wastes in Malaysia
2 March 1996

28. Prof. Dr. Wan Sulaiman Wan Harun
Soil Physics: From Glass Beads to Precision Agriculture
16 March 1996

29. Prof. Dr. Abdul Aziz Abdul Rahman
Sustained Growth and Sustainable Development: Is there a Trade-Off 1 or Malaysia
13 April 1996

30. Prof. Dr. Chew Tek Ann
Sharecropping in Perfectly Competitive Markets: A Contradiction in Terms
27 April 1996

31. Prof. Dr. Mohd. Yusuf Sulaiman
Back to the Future with the Sun
18 May 1996

32. Prof. Dr. Abu Bakar Salleh
Enzyme Technology: The Basis for Biotechnological Development
8 June 1996

33. Prof. Dr. Kamel Ariffin Mohd. Atan
The Fascinating Numbers
29 June 1996

34. Prof. Dr. Ho Yin Wan
Fungi: Friends or Foes
27 July 1996

35. Prof. Dr. Tan Soon Guan
Genetic Diversity of Some Southeast Asian Animals: Of Buffaloes and Goats and Fishes Too
10 August 1996

36. Prof. Dr. Nazaruddin Mohd. Jali
Will Rural Sociology Remain Relevant in the 21st Century?
21 September 1996

37. Prof. Dr. Abdul Rani Bahaman
Leptospirosis-A Model for Epidemiology, Diagnosis and Control of Infectious Diseases
16 November 1996

38. Prof. Dr. Marziah Mahmood
Plant Biotechnology - Strategies for Commercialization
21 December 1996

39. Prof. Dr. Ishak Hj. Omar
Market Relationships in the Malaysian Fish Trade: Theory and Application
22 March 1997

40. Prof. Dr. Suhaila Mohamad
Food and its Healing Power
12 April 1997

41. Prof. Dr. Malay Raj Mukerjee
A Distributed Collaborative Environment for Distance Learning Applications
17 June 1998

42. Prof. Dr. Wong Kai Choo
Advancing the Fruit Industry in Malaysia: A Need to Shift Research Emphasis
15 May 1999

43. Prof. Dr. Aini Ideris
Avian Respiratory and Immunosuppressive Diseases- A Fatal Attraction
10 July 1999

44. Prof. Dr. Sariah Meon
Biological Control of Plant Pathogens: Harnessing the Richness of Microbial Diversity
14 August 1999

45. Prof. Dr. Azizah Hashim
The Endomycorrhiza: A Futile Investment?
23 October 1999

46. Prof. Dr. Noraini Abdul Samad
Molecular Plant Virology: The Way Forward
2 February 2000

47. Prof. Dr. Muhamad Awang
Do We Have Enough Clean Air to Breathe?
7 April 2000

48. Prof. Dr. Lee Chnoong Kheng
Green Environment, Clean Power
24 June 2000

49. Prof. Dr. Mohd. Ghazali Mohayidin
Managing Change in the Agriculture Sector: The Need for Innovative Educational Initiatives
12 January 2002

50. Prof. Dr. Fatimah Mohd. Arshad
Analisis Pemasaran Pertanian di Malaysia: Keperluan Agenda Pembaharuan
26 January 2002

51. Prof. Dr. Nik Mustapha R. Abdullah
Fisheries Co-Management: An Institutional Innovation Towards Sustainable Fisheries Industry
28 February 2002

52. Prof. Dr. Gulam Rusul Rahmat Ali
Food Safety: Perspectives and Challenges
23 March 2002

53. Prof. Dr. Zaharah A. Rahman
Nutrient Management Strategies for Sustainable Crop Production in Acid Soils: The Role of Research Using Isotopes
13 April 2002

54. Prof. Dr. Maisom Abdullah
Productivity Driven Growth: Problems & Possibilities
27 April 2002

55. Prof. Dr. Wan Omar Abdullah
Immunodiagnosis and Vaccination for Brugian Filariasis: Direct Rewards from Research Investments
6 June 2002

56. Prof. Dr. Syed Tajuddin Syed Hassan
Agro-ento Bioinformation: Towards the Edge of Reality
22 June 2002

57. Prof. Dr. Dahlan Ismail
Sustainability of Tropical Animal-Agricultural Production Systems: Integration of Dynamic Complex Systems
27 June 2002

58. Prof. Dr. Ahmad Zubaidi Baharumshah
The Economics of Exchange Rates in the East Asian Countries
26 October 2002

59. Prof. Dr. Shaik Md. Noor Alam S.M. Hussain
Contractual Justice in Asean: A Comparative View of Coercion
31 October 2002

60. Prof. Dr. Wan Md. Zin Wan Yunus
Chemical Modification of Polymers: Current and Future Routes for Synthesizing New Polymeric Compounds
9 November 2002

61. Prof. Dr. Annuar Md. Nassir
Is the KLSE Efficient? Efficient Market Hypothesis vs Behavioural Finance
23 November 2002

62. Prof. Ir. Dr. Radin Umar Radin Sohadi
Road Safety Interventions in Malaysia: How Effective Are They?
21 February 2003

63. Prof. Dr. Shamsher Mohamad
The New Shares Market: Regulatory Intervention, Forecast Errors and Challenges
26 April 2003

64. Prof. Dr. Han Chun Kwong
Blueprint for Transformation or Business as Usual? A Structurational Perspective of the Knowledge-Based Economy in Malaysia
31 May 2003

65. Prof. Dr. Mawardi Rahmani
Chemical Diversity of Malaysian Flora: Potential Source of Rich Therapeutic Chemicals
26 July 2003

66. Prof. Dr. Fatimah Md. Yusoff
An Ecological Approach: A Viable Option for Aquaculture Industry in Malaysia
9 August 2003

67. Prof. Dr. Mohamed Ali Rajion
The Essential Fatty Acids-Revisited
23 August 2003

68. Prof. Dr. Azhar Md. Zain
Psychotheraphy for Rural Malays - Does it Work?
13 September 2003

69. Prof. Dr. Mohd. Zamri Saad
Respiratory Tract Infection: Establishment and Control
27 September 2003

70. Prof. Dr. Jinap Selamat
Cocoa-Wonders for Chocolate Lovers
14 February 2004

71. Prof. Dr. Abdul Halim Shaari
High Temperature Superconductivity: Puzzle & Promises
13 March 2004

72. Prof. Dr. Yaakob Che Man
Oils and Fats Analysis - Recent Advances and Future Prospects
27 March 2004

73. Prof. Dr. Kaida Khalid
Microwave Aquametry: A Growing Technology
24 April 2004

74. Prof. Dr. Hasanah Mohd. Ghazali
Tapping the Power of Enzymes-Greening the Food Industry
11 May 2004

75. Prof. Dr. Yusof Ibrahim
The Spider Mite Saga: Quest for Biorational Management Strategies
22 May 2004

76. Prof. Datin Dr. Sharifah Md. Nor
The Education of At-Risk Children: The Challenges Ahead
26 June 2004

77. Prof. Dr. Ir. Wan Ishak Wan Ismail
Agricultural Robot: A New Technology Development for Agro-Based Industry
14 August 2004

78. Prof. Dr. Ahmad Said Sajap
Insect Diseases: Resources for Biopesticide Development
28 August 2004

79. Prof. Dr. Aminah Ahmad
The Interface of Work and Family Roles: A Quest for Balanced Lives
11 March 2005

80. Prof. Dr. Abdul Razak Alimon
Challenges in Feeding Livestock: From Wastes to Feed
23 April 2005

81. Prof. Dr. Haji Azimi Hj. Hamzah
Helping Malaysian Youth Move Forward: Unleashing the Prime Enablers
29 April 2005

82. Prof. Dr. Rasedee Abdullah
In Search of an Early Indicator of Kidney Disease
27 May 2005

83. Prof. Dr. Zulkifli Hj. Shamsuddin
Smart Partnership: Plant-Rhizobacteria Associations
17 June 2005

84. Prof. Dr. Mohd Khanif Yusop
From the Soil to the Table
1 July 2005

85. Prof. Dr. Annuar Kassim
Materials Science and Technology: Past, Present and the Future
8 July 2005

86. Prof. Dr. Othman Mohamed
Enhancing Career Development Counselling and the Beauty of Career Games
12 August 2005

87. Prof. Ir. Dr. Mohd Amin Mohd Soom
Engineering Agricultural Water Management Towards Precision Framing
26 August 2005

88. Prof. Dr. Mohd Arif Syed
Bioremediation-A Hope Yet for the Environment?
9 September 2005

89. Prof. Dr. Abdul Hamid Abdul Rashid
The Wonder of Our Neuromotor System and the Technological Challenges They Pose
23 December 2005

90. Prof. Dr. Norhani Abdullah
Rumen Microbes and Some of Their Biotechnological Applications
27 January 2006

91. Prof. Dr. Abdul Aziz Saharee
Haemorrhagic Septicaemia in Cattle and Buffaloes: Are We Ready for Freedom?
24 February 2006

92. Prof. Dr. Kamariah Abu Bakar
Activating Teachers' Knowledge and Lifelong Journey in Their Professional Development
3 March 2006

93. Prof. Dr. Borhanuddin Mohd. Ali
Internet Unwired
24 March 2006

94. Prof. Dr. Sundararajan Thilagar
Development and Innovation in the Fracture Management of Animals
31 March 2006

95. Prof. Dr. Zainal Aznam Md. Jelan
Strategic Feeding for a Sustainable Ruminant Farming
19 May 2006

96. Prof. Dr. Mahiran Basri
Green Organic Chemistry: Enzyme at Work
14 July 2006

97. Prof. Dr. Malik Hj. Abu Hassan
Towards Large Scale Unconstrained Optimization
20 April 2007

98. Prof. Dr. Khalid Abdul Rahim
Trade and Sustainable Development: Lessons from Malaysia's Experience
22 June 2007

99. Prof. Dr. Mad Nasir Shamsudin
Econometric Modelling for Agricultural Policy Analysis and Forecasting: Between Theory and Reality
13 July 2007

100. Prof. Dr. Zainal Abidin Mohamed
Managing Change - The Fads and The Realities: A Look at Process Reengineering, Knowledge Management and Blue Ocean Strategy
9 November 2007

101. Prof. Ir. Dr. Mohamed Daud
Expert Systems for Environmental Impacts and Ecotourism Assessments
23 November 2007

102. Prof. Dr. Saleha Abdul Aziz
Pathogens and Residues; How Safe is Our Meat?
30 November 2007

103. Prof. Dr. Jayum A. Jawan
Hubungan Sesama Manusia
7 December 2007

104. Prof. Dr. Zakariah Abdul Rashid
Planning for Equal Income Distribution in Malaysia: A General Equilibrium Approach
28 December 2007

105. Prof. Datin Paduka Dr. Khatijah Yusoff
Newcastle Disease virus: A Journey from Poultry to Cancer
11 January 2008

106. Prof. Dr. Dzulkefly Kuang Abdullah
Palm Oil: Still the Best Choice
1 February 2008

107. Prof. Dr. Elias Saion
Probing the Microscopic Worlds by Lonizing Radiation
22 February 2008

108. Prof. Dr. Mohd Ali Hassan
Waste-to-Wealth Through Biotechnology: For Profit, People and Planet
28 March 2008

109. Prof. Dr. Mohd Maarof H. A. Moksin
Metrology at Nanoscale: Thermal Wave Probe Made It Simple
11 April 2008

110. Prof. Dr. Dzolkhifli Omar
The Future of Pesticides Technology in Agriculture: Maximum Target Kill with Minimum Collateral Damage
25 April 2008

111. Prof. Dr. Mohd. Yazid Abd. Manap
Probiotics: Your Friendly Gut Bacteria
9 May 2008

112. Prof. Dr. Hamami Sahri
Sustainable Supply of Wood and Fibre: Does Malaysia have Enough?
23 May 2008

113. Prof. Dato' Dr. Makhdzir Mardan
Connecting the Bee Dots
20 June 2008

114. Prof. Dr. Maimunah Ismail
Gender & Career: Realities and Challenges
25 July 2008

115. Prof. Dr. Nor Aripin Shamaan
Biochemistry of Xenobiotics: Towards a Healthy Lifestyle and Safe Environment
1 August 2008

116. Prof. Dr. Mohd Yunus Abdullah
Penjagaan Kesihatan Primer di Malaysia: Cabaran Prospek dan Implikasi dalam Latihan dan Penyelidikan Perubatan serta Sains Kesihatan di Universiti Putra Malaysia
8 August 2008

117. Prof. Dr. Musa Abu Hassan
Memanfaatkan Teknologi Maklumat & Komunikasi ICT untuk Semua
15 August 2008

118. Prof. Dr. Md. Salleh Hj. Hassan
Role of Media in Development: Strategies, Issues & Challenges
22 August 2008

119. Prof. Dr. Jariah Masud
Gender in Everyday Life
10 October 2008

120 Prof. Dr. Mohd Shahwahid Haji Othman
Mainstreaming Environment: Incorporating Economic Valuation and Market-Based Instruments in Decision Making
24 October 2008

121. Prof. Dr. Son Radu
Big Questions Small Worlds: Following Diverse Vistas
31 October 2008

122. Prof. Dr. Russly Abdul Rahman
Responding to Changing Lifestyles: Engineering the Convenience Foods
28 November 2008

123. Prof. Dr. Mustafa Kamal Mohd Shariff
Aesthetics in the Environment an Exploration of Environmental: Perception Through Landscape Preference
9 January 2009

124. Prof. Dr. Abu Daud Silong
Leadership Theories, Research & Practices: Farming Future Leadership Thinking
16 January 2009

125. Prof. Dr. Azni Idris
Waste Management, What is the Choice: Land Disposal or Biofuel?
23 January 2009

126. Prof. Dr. Jamilah Bakar
Freshwater Fish: The Overlooked Alternative
30 January 2009

127. Prof. Dr. Mohd. Zobir Hussein
The Chemistry of Nanomaterial and Nanobiomaterial
6 February 2009

128. Prof. Ir. Dr. Lee Teang Shui
Engineering Agricultural: Water Resources
20 February 2009

129. Prof. Dr. Ghizan Saleh
Crop Breeding: Exploiting Genes for Food and Feed
6 March 2009

130. Prof. Dr. Muzafar Shah Habibullah
Money Demand
27 March 2009

131. Prof. Dr. Karen Anne Crouse
In Search of Small Active Molecules
3 April 2009

132. Prof. Dr. Turiman Suandi
Volunteerism: Expanding the Frontiers of Youth Development
17 April 2009

133. Prof. Dr. Arbakariya Ariff
Industrializing Biotechnology: Roles of Fermentation and Bioprocess Technology
8 May 2009

134. Prof. Ir. Dr. Desa Ahmad
Mechanics of Tillage Implements
12 June 2009

135. Prof. Dr. W. Mahmood Mat Yunus
Photothermal and Photoacoustic: From Basic Research to Industrial Applications
10 July 2009

136. Prof. Dr. Taufiq Yap Yun Hin
Catalysis for a Sustainable World
7 August 2009

137 Prof. Dr. Raja Noor Zaliha Raja Abd. Rahman
Microbial Enzymes: From Earth to Space
9 October 2009

138 Prof. Ir. Dr. Barkawi Sahari
Materials, Energy and CNGDI Vehicle Engineering
6 November 2009

139. Prof. Dr. Zulkifli Idrus
Poultry Welfare in Modern Agriculture: Opportunity or Threat?
13 November 2009

140. Prof. Dr. Mohamed Hanafi Musa
Managing Phosphorus: Under Acid Soils Environment
8 January 2010

141. Prof. Dr. Abdul Manan Mat Jais
Haruan Channa striatus a Drug Discovery in an Agro-Industry Setting
12 March 2010

142. Prof. Dr. Bujang Bin Kim Huat
Problematic Soils: In Search for Solution
19 March 2010

143. Prof. Dr. Samsinar Md Sidin
Family Purchase Decision Making: Current Issues & Future Challenges
16 April 2010

144. Prof. Dr. Mohd Adzir Mahdi
Lightspeed: Catch Me If You Can
4 June 2010

145. Prof. Dr. Raha Hj. Abdul Rahim
Designer Genes: Fashioning Mission Purposed Microbes
18 June 2010

146. Prof. Dr. Hj. Hamidon Hj. Basri
A Stroke of Hope, A New Beginning
2 July 2010

147. Prof. Dr. Hj. Kamaruzaman Jusoff
Going Hyperspectral: The "Unseen" Captured?
16 July 2010

148. Prof. Dr. Mohd Sapuan Salit
Concurrent Engineering for Composites
30 July 2010

149. Prof. Dr. Shattri Mansor
Google the Earth: What's Next?
15 October 2010

150. Prof. Dr. Mohd Basyaruddin Abdul Rahman
Haute Couture: Molecules & Biocatalysts
29 October 2010

151. Prof. Dr. Mohd. Hair Bejo
Poultry Vaccines: An Innovation for Food Safety and Security
12 November 2010

152. Prof. Dr. Umi Kalsom Yusuf
Fern of Malaysian Rain Forest
3 December 2010

153. Prof. Dr. Ab. Rahim Bakar
Preparing Malaysian Youths for the World of Work: Roles of Technical and Vocational Education and Training (TVET)
14 January 2011

154. Prof. Dr. Seow Heng Fong
Are there "Magic Bullets" for Cancer Therapy?
11 February 2011

155. Prof. Dr. Mohd Azmi Mohd Lila
Biopharmaceuticals: Protection, Cure and the Real Winner
18 February 2011

156. Prof. Dr. Siti Shapor Siraj
Genetic Manipulation in Farmed Fish: Enhancing Aquaculture Production
25 March 2011

157. Prof. Dr. Ahmad Ismail
Coastal Biodiversity and Pollution: A Continuous Conflict
22 April 2011

158. Prof. Ir. Dr. Norman Mariun
Energy Crisis 2050? Global Scenario and Way Forward for Malaysia
10 June 2011

159. Prof. Dr. Mohd Razi Ismail
Managing Plant Under Stress: A Challenge for Food Security
15 July 2011

160. Prof. Dr. Patimah Ismail
Does Genetic Polymorphisms Affect Health?
23 September 2011

161. Prof. Dr. Sidek Ab. Aziz
Wonders of Glass: Synthesis, Elasticity and Application
7 October 2011

162. Prof. Dr. Azizah Osman
Fruits: Nutritious, Colourful, Yet Fragile Gifts of Nature
14 October 2011

163. Prof. Dr. Mohd. Fauzi Ramlan
Climate Change: Crop Performance and Potential
11 November 2011

164. Prof. Dr. Adem Kiliçman
Mathematical Modeling with Generalized Function
25 November 2011

165. Prof. Dr. Fauziah Othman
My Small World: In Biomedical Research
23 December 2011

166. Prof. Dr. Japar Sidik Bujang
The Marine Angiosperms, Seagrass
23 March 2012

167. Prof. Dr. Zailina Hashim
Air Quality and Children's Environmental Health: Is Our Future Generation at Risk?
30 March 2012

168. Prof. Dr. Zainal Abidin Mohamed
Where is the Beef? Vantage Point form the Livestock Supply Chain
27 April 2012

169. Prof. Dr. Jothi Malar Panandam
Genetic Characterisation of Animal Genetic Resources for Sustaninable Utilisation and Development
30 November 2012

170. Prof. Dr. Fatimah Abu Bakar
The Good The Bad & Ugly of Food Safety: From Molecules to Microbes
7 December 2012

171. Prof. Dr. Abdul Jalil Nordin
My Colourful Sketches from Scratch: Molecular Imaging
5 April 2013

172. Prof. Dr. Norlijah Othman
Lower Respiratory Infections in Children: New Pathogens, Old Pathogens and the Way Forward
19 April 2013

173. Prof. Dr. Jayakaran Mukundan
Steroid-like Prescriptions English Language Teaching Can Ill-afford
26 April 2013

174. Prof. Dr. Azmi Zakaria
Photothermals Affect Our Lives
7 June 2013

175. Prof. Dr. Rahinah Ibrahim
Design Informatics
21 June 2013

176. Prof. Dr. Gwendoline Ee Cheng
Natural Products from Malaysian Rainforests
1 November 2013

177. Prof. Dr. Noor Akma Ibrahim
The Many Facets of Statistical Modeling
22 November 2013

178. Prof. Dr. Paridah Md. Tahir
Bonding with Natural Fibres
6 December 2013

179. Prof. Dr. Abd. Wahid Haron
Livestock Breeding: The Past, The Present and The Future
9 December 2013

180. Prof. Dr. Aziz Arshad
Exploring Biodiversity & Fisheries Biology: A Fundamental Knowledge for Sustainabale Fish Production
24 January 2014

181. Prof. Dr. Mohd Mansor Ismail
Competitiveness of Beekeeping Industry in Malaysia
21 March 2014

182. Prof. Dato' Dr. Tai Shzee Yew
Food and Wealth from the Seas: Health Check for the Marine Fisheries of Malaysia
25 April 2014

183. Prof. Datin Dr. Rosenani Abu Bakar
Waste to Health: Organic Waste Management for Sustainable Soil Management and Crop Production
9 May 2014

184. Prof. Dr. Abdul Rahman Omar
Poultry Viruses: From Threat to Therapy
23 May 2014

185. Prof. Dr. Mohamad Pauzi Zakaria
Tracing the Untraceable: Fingerprinting Pollutants through Environmental Forensics
13 June 2014

186. Prof. Dr. -Ing. Ir. Renuganth Varatharajoo
Space System Trade-offs: Towards Spacecraft Synergisms
15 August 2014

187. Prof. Dr. Latiffah A. Latiff
Tranformasi Kesihatan Wanita ke Arah Kesejahteraan Komuniti
7 November 2014

188. Prof. Dr. Tan Chin Ping
Fat and Oils for a Healthier Future: Makro, Micro and Nanoscales
21 November 2014

189. Prof. Dr. Suraini Abd. Aziz
Lignocellulosic Biofuel: A Way Forward
28 November 2014

190. Prof. Dr. Robiah Yunus
Biobased Lubricants: Harnessing the Richness of Agriculture Resources
30 January 2015

191. Prof. Dr. Khozirah Shaari
Discovering Future Cures from Phytochemistry to Metabolomics
13 February 2015

192. Prof. Dr. Tengku Aizan Tengku Abdul Hamid
Population Ageing in Malaysia: A Mosaic of Issues, Challenges and Prospects
13 March 2015

193. Prof. Datin Dr. Faridah Hanum Ibrahim
Forest Biodiversity: Importance of Species Composition Studies
27 March 2015

194. Prof. Dr. Mohd Salleh Kamarudin
Feeding & Nutritional Requirements of Young Fish
10 April 2015

195. Prof. Dato' Dr. Mohammad Shatar Sabran
Money Boy: Masalah Sosial Era Generasi Y
8 Mei 2015

196. Prof. Dr. Aida Suraya Md. Yunus
Developing Students' Mathematical Thinking: How Far Have We Come?
5 June 2015

197. Prof. Dr. Amin Ismail
Malaysian Cocoa or Chocolates: A Story of Antioxidants and More...
14 August 2015

198. Prof. Dr. Shamsuddin Sulaiman
Casting Technology: Sustainable Metal Forming Process
21 August 2015

199. Prof. Dr. Rozita Rosli
Journey into Genetic: Taking the Twists and Turns of Life
23 October 2015

200. Prof. Dr. Nor Aini Ab Shukor
The Un(Straight) Truth About Trees
6 November 2015

201. Prof. Dato' Dr. Ir Mohd Saleh Jaafar
Advancing Concrete Materials and Systems: The Search Continues
13 November 2015

202. Prof. Dr. Maznah Ismail
Germinated Brown Rice and Bioactive Rich Fractions: On Going Journey form R&D to Commercialisation
29 April 2016

203. Prof. Dr. Habshah Midi
Amazing Journey to Robust Statistics Discovering Outliers for Efficient Prediction
6 May 2016

204. Prof. Dr. Mansor Ahmad @ Ayob
Going Green with Bionanocomposites
27 May 2016

205. Prof. Dr. Fudziah Ismail
Exploring Efficient Numerical Methods for Differental Equations
23 September 2016

206. Prof. Dr. Noordin Mohamed Mustapha
Meandering Through the Superb Scientific World of Pathology: Exploring Intrapolations
30 September 2016

207. Prof. Dr. Mohd. Majid Konting
Teaching for Quality Learning: A Leadership Challenge
21 October 2016

208. Prof. Dr. Ezhar Tamam
Are University Students Getting Enough Interethnic Communication and Diversity Engagement Experiences? Concerns and Considerations
11 November 2016

209. Prof. Dr. Bahaman Abu Samah
Enhancing Extension Research using Structural Equation Modeling
18 November 2016

210. Prof. Dr. Wen Siang Tan
Fighting the Hepatitis B Virus: Past, Present & Future
9 December 2016

211. Prof. Dr. Mahmud Tengku Muda Mohamed
Postharvest: An Unsung Solution for Food Security
20 January 2017

212. Prof. Dr. Sherina Mohd Sidik
Mental Health in the Community-Malaysia: A 20-Year Journey of a Family Medicine Consultant
27 January 2017

213. Prof. Dr. Zaidon Ashaari
Low Density Wood: From Poor to Excellent
10 Februari 2017

214. Prof. Ir. Dr. Mohd Zainal Ab. Kadir
Lightning: A Bolt from the Blue
17 February 2017

215. Prof. Datin Dr. Rozi Mahmud
No Less Than a Women: Improving Breast Cancer Detection and Diagnosis
17 Mac 2017

216. Prof. Dr. Jegatheswaran Ratnasingam
The Malaysian Furniture Industry: Charting its Growth Potential
7 April 2017

217. Prof. Dr. Loh Teck Chewn
Animal Feed: The Way Forward
21 April 2017

218. Prof. Dr. Luqman Chuah Abdullah
Rigid Ceramic Filters: Numerical Simulation of The Pressure & Velocity Distributions
5 May 2017

219. Prof. Dr. Lai Oi Ming
Diacylglycerols: Healty Fats of the Future
19 May 2017

220. Prof. Dr. Rozumah Baharudin
Parenting: What Matters Most?
25 May 2017

221. Prof. Dr. Laily Paim
Kemiskinan & Kerentaan: Penelitian Konsep dan Pengukuran dalam Era Revolusi Indsutri 4.0
20 Oktober 2017

222. Prof. Dr. Shuhaimi Mustafa
Halal Food Authenticity: Does it Matter to You?
25 November 2017

223. Prof. Dr. Che Fauziah Ishak
Solid Waste Management: Land Application of Agricultural and Industrial by Products
9 Mac 2018

224. Prof. Dr. Manohar Arumugam
Repair, Reconstruction, Replacement and Reduction of Musculoskeletal Disorders & Limb Injuries
16 Mac 2018

225. Prof. Dr. Sidek Mohd Noah
Aplikasi Ujian Psikometrik dalam Bimbingan dan Kaunseling Kerjaya: Sejauh Mana Impaknya?
13 April 2018

226. Prof. Dr. Zamberi Sekawi
Living Dangerously in a Virus World: Losing End?
20 April 2018

INDEX